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THE NAUTILUS

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A NOTE ON THE FLYING BEHAVIOR OF CERTAIN SQUIDS [1]

By GEORGE F. ARATA, JR.[2]

In view of the interest in the flying or leaping behavior of some of the squids (Rees, 1949) the following account is considered noteworthy. Observations were made on the mechanism by which the squid is enabled to break the surface of the water and on the manner in which the animal is held suspended in flight. Rees mentions many accounts where squid have appeared on the decks of vessels during a voyage, but hitherto there have been no reports of the actual flight.

Several instances are reported here which indicate that some squids are not only capable of leaping out of the water, but are also capable of fairly long-sustained flights.

The first observation, involving by far the most spectacular flight, took place at 36° 43.5′ north latitude and 79° 20′ west longitude on board the U. S. Fish and Wildlife Service vessel *Theodore N. Gill.* On July 29, 1953, at 11:15 A.M., during a flat calm with a moderate NE ground swell and with the vessel heading N at nine knots, a six inch squid was observed as it glided across the bow of the vessel. The distance of this leap could not be determined as only the final stages were seen. However, after striking the water in front of the vessel the animal remained motionless until the bow of the approaching

[1] Contribution No. 126 from the Marine Laboratory, University of Miami.

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NOTE: Observations resulting from vessel operation of the South Atlantic Fishery Investigations, in cooperation with the U. S. Fish and Wildlife Service, Office of Naval Research, U. S. Naval Hydrographic Office, and the States of Florida and Georgia.

vessel came to within about ten feet. At this time the squid darted to one side, turned and leaped from the water backwards, emitting a fine stream of water from the head region, which at this time was to the rear in relation to the direction of flight. By the time the jet of water had ceased flowing the fins were spread and the tentacles were pressed together (side by side and seemingly curved downward) forming a sort of hood to add to the supporting elements needed for flight. The squid attained a height of about six to eight feet from the water surface and shot in a straight line diagonally across the bow of the vessel for approximately forty to fifty feet and landed in the water flat on its ventral surface. As the weather was flat calm there was no wind to support this flight. It might be added here that the day was bright and clear. During the morning many slicks were seen and also frequent patches of sargassum weed. Many flying fish (*Cypselurus heterurus*) were also observed.

When first seen the dorsal surface of this squid was colored royal blue, which closely matched the water color. Upon striking the water the blue color immediately faded and the animal remained motionless, showing a complete absence of pigmentation. When the squid darted from side to side under the water surface this lack of pigmentation was evident and no color returned until flight was resumed. Upon alighting the second time the color again faded, but only for an instant. As the bow of the vessel approached, the squid turned dark red and was last seen swimming downward.

The second instance of leaping or flight occurred at approximately 26° 24′ north latitude and 76° 48′ west longitude while on station. Night fishing operations with a light had just been started at dusk and two small squids were seen feeding at the surface. A small shark (*Carcharhinus longimanus*), which was captured later, swam up under them and at that instant the two squid turned dark red and shot from the water, using a jet of water for propulsion in a manner similar to that described above. They leaped approximately eight feet above the water surface and sailed into the bulkhead of the vessel just under the boat deck.

The weather conditions that prevailed during the second observation were similar to the first except that a slight chop was coming from the east. The fishing operations were carried out

facing east so the squid in this case took off downwind, which would further substantiate their ability of supported flight.

Although the specimens mentioned were not recovered, three additional specimens were captured via dip-net in the same area and were identified by Mr. Gilbert L. Voss of the Marine Laboratory, University of Miami, as *Stenoteuthis bartrami* and *Ommastrephes sagittatus.* The latter has apparently never been reported as flying and it is not certain that the observations recorded here pertain to this species. Members of the family Ommastrephidae are known as the "flying squids" and have been reported from the decks of vessels, but since the actual specimens were not captured in this case, no positive statements can be made. Members of the genus *Stenoteuthis* are similar in body to *Ommastrephes,* and it is possible that a member of this genus was one of those seen in flight.

A third observation of flight was made by a deckhand on board the vessel on January 30, 1954, at 0850. This occurred at approximately 27° 00′ N latitude and 79° 18′ W longitude. The squid was seen breaking the surface tail first, emitting a fine jet of water and sailing about twenty feet diagonally across the bow. The vessel was steering 332°, there was a ten knot NE wind and there was a slight surface chop. Contrary to the case in the instances previous, this squid took off quartering the wind.

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NOTES ON MEXICAN MOLLUSKS. I: DURANGO, COAHUILA AND TAMAULIPAS, WITH DESCRIPTION OF TWO NEW HUMBOLDTIANA

By ALAN SOLEM

Museum of Zoology, University of Michigan

In recent years a number of lots of mollusks have been brought back from Mexico by staff members and students of the University Museums. While from widely scattered localities and gen-

erally consisting of only a few specimens, they are of great interest as the localities represented are generally very inaccessible and but little of Mexico is well known conchologically. Reports are being prepared on the material and, for convenience, are being grouped geographically.

In the course of paleontological field work, Robert M. Linsley of the University Museum of Paleontology collected a few mollusks from the Durango-Coahuila border. The specimens were found near the central portion of the Sierra de Tlahualilo, and 25 miles north of the town of Tlahualilo.

Bulimulus (*Rhabdotus*) *schiedeanus* (Prr.) was found aestivating on bushes both on the plain (ca. 3600′) and on the top of the range (ca. 4800′).

Holospira (*Halplocion*) *durangoensis* Bartsch (1906: 142–143) was found on the faces of limestone rock on the slope of the mountain only. Previously reported only from Durango, Durango, this species was omitted from the summary of *Haplocion* given by Bartsch (1943: 56), but included by Pilsbry (1953: 151). Adult, non-decollated specimens have 11–13 whorls and range in length from 26–32 mm.

In 1948 Paul S. Martin of the Museum of Zoology collected three specimens of a *Humboldtiana* from western Durango, which, on the basis of conchological characteristics, appears to be new. The extent of speciation in *Humboldtiana* will probably be discovered to be as great as in *Helminthoglypta* and just as complex. The exact status of the forms described here and previously described entities cannot be finally settled until a vast amount of material has been collected and studied. The described forms are being erected on the basis of conchological characters and different geographic locality from related species. It is recognized that extensive collections from Mexico may completely change the status of these forms, but they are distinct on the basis of known material.

HUMBOLDTIANA DURANGOENSIS, n.sp. Pl. 1, figs. 2, 6

Type: University of Michigan Museum of Zoology 169746, in pine woods at 8000′, Laguna del Progresso (a mill of the Pacific Lumber Co.), 30 mi. NNW of Los Coyotes and 25 mi. NNW of El Salto, Durango, Mexico.

Diagnosis: A species of *Humboldtiana* distinguished from *H. nuevoleonis* by its larger nuclear whorls, higher spire, more rounded contours and smaller granules comprising its sculpture; from *H. taylori* Drake by its larger nuclear whorls, more impressed sutures, much smaller granular sculpture and different coloration.

Description: Shell ovate-globose, rather heavy; 4–4½ whorls, first one and three-quarters embryonic, smooth, shining, remaining whorls densely covered with round to oval granulations occurring 5–6 per millimeter both longitudinally and spirally; growth wrinkles present but not prominent; ground color light olive-brown interrupted by numerous white streaks; body whorl with three spiral chocolate-brown bands, the upper and lower equal in size, the middle one about ⅔ as wide; last whorl descending; aperture ovate; columellar margin broadly reflected over the umbilicus, but not sealing it; basal margin of shell slightly reflected; parietal callus thin, transparent. Height 37.3 mm.; diameter 39.4 mm.; height of aperture 28.2 mm.; diameter 22.9 mm.

Paratypes: UMMZ 169745, two specimens collected March 26, 1948, near a cave at the same locality. Largest specimen measuring 41.5 mm. in diameter and 39.4 mm. in height. Coloration and sculpture as in type. Two more paratypes were collected by I. J. Cantrall March 24, 1953, at 8000′ about 2.5 mi. W of San Luis, Durango. They are slightly smaller than the other specimens, but still much, much larger than some forms discussed below. San Luis and Laguna del Progreso are within 10 km. or so of each other and are located about 110 km. west of Durango City near the Durango-Sinaloa border.

Discussion: The exact phylogenetic relationships of the form cannot be determined until the anatomy is known, as better criteria for specific separation exist in the genitalia than in the shell. Conchologically, however, it is most similar to the Coahuilan *H. taylori* and *H. nuevoleonis* of Monterrey and vicinity. Nevertheless, I believe its true affinities lie somewhere between the heavily sculptured group of *H. humboldtiana* (= *hegewischi* von Martens) together with the Zacatecan *H. chrysogona* and non-granulated *H. hogeana* group of Chihuahua. In other groups of animals some similarities have recently been noted between the fauna of the Eastern and Western Mexican pine forest regions, so that the first relationship remains a distinct possibility.

From the southern forms mentioned above, *H. durangoensis* is separated by its much larger size, proportionately wider color bands and smaller granulations. Differences from the superficially similar eastern Mexican forms have been determined by comparison with authentic material. UMMZ 92404 is type lot material of *H. nuevoleonis*. No paratypes of *H. taylori* Drake were available, but Chicago Natural History Museum 22369 contains eight young specimens of *H. taylori* Drake collected by Dr. K. P. Schmidt on April 3, 1945, at Campo Central (El Jardin), 20 miles SE of Boquillas, Coahuila at 5400′. This locality is within five miles of Drake's type locality and the shells match Drake's description perfectly. The essential differences are given in the diagnosis and are not repeated here. A type lot specimen of *H. nuevoleonis* is figured in Plate 1, figs. 1, 5, to indicate the difference in nuclear whorls and shell contour.

The only other record of a *Humboldtiana* from Durango is given by van Martens (1890: 147) who reports specimens of *H. hegewischi* (= *humboldtiana* Pfr., see Pilsbry 1948: 185) from Ciudad in the northern part of the state. This record needs confirmation.

Dr. Cantrall also collected several more lots of shells from Durango. The following species were included:

Pisidium abditum Haldeman. A number of young sphaerids which seem to belong to this species were collected from the locality near San Luis and the Laguna del Progreso.

Polygyra matermontana Pilsbry. This group is a very difficult one and much work remains to be done in working out their relationship. Specimens from San Luis are placed in this species on the basis of a comparison with a paratype of *P. matermontana* (UMMZ 113187) from the John Ponsonby collection. The Durangoan specimens have a narrower umbilicus, but are identical to the paratype in shape and armature. There are also specimens of this species from Taxco, Guerrero in the Michigan collection.

Ferrissia (*Laevapex*) *excentrica* (Morelet). I have assigned a number of specimens from the Laguna del Progreso to this species with some hesitation. Typical *excentrica* appears to be heavily radially striate, while only a few of the Durangan specimens have heavy sculpture. In this respect, a number of speci-

mens could be assigned to *F.* (*L.*) *papillaris* (von Martens). After carefully examining the extensive series of *excentrica* in the Walker collection, I am inclined to consider that the two "species" may be extreme variations of one form.

Since the pioneer works of Fischer and Crosse, Strebel and Pfeffer and von Martens, Pilsbry (1903, 1928) and Dall (1908) are major sources for records in Tamaulipas. Material collected by C. F. Walker in 1950 and by Paul S. Martin and B. E. Harrell in February 1953 provide several additional records.

Aperostoma (*A.*) *mexicanum salleanum* (von Martens). Specimens from Rancho del Cielo (7 km. north of Gómez Farías) and another locality 20 km. north of Chamal, both in the Sierra Madre Oriental of southwest Tamaulipas, all well within the range of variation shown by H. B. Baker's Vera Cruz material (see Baker 1928). Although its presence in Tamaulipas is not surprising, I believe this is the first record for the state as it was not reported by Pilsbry (1903) in the Rhoads collections.

Mesomphix (*Omphalinella*) *montereyensis victorianus* Pilsbry. Specimens from each of the above localities.

Coelocentrum (*Crossostephanus*) *palmeri* Dall and Bartsch. Specimens from the Rancho del Cielo, Chamal and the Aserradero del Paraiso, 15 km. NNW of Chamal. Chamal is a small town located midway between Ocampo and El Limon. The fresh specimens are much slenderer than the figured form (Dall 1908: pl. 29, figs. 2, 5), but are identical in columellar characters and external sculpture. The original locality was simply "Tamaulipas."

Ceres nelsoni Dall (1898: 27). A single specimen from Aserradero del Paraiso, 15 km. N of Chamal at 1500′ in humid lowland forest. Identical with the figures (Dall 1902: pl. 28, figs. 1, 3, 5, 8) of the San Luis Potosí specimens. To the original description it might be added that the lamellae extend back one-sixth whorl and that with the exception of the one-sixth whorl bearing the lamellae, there are no internal partitions present. H. Burrington Baker (personal communication) informs me that *Ceres* is probably related to the South American *Linidiella* (= *Cyane* Adams, not Felder, 1861) and with it forms a tribe of the Helicininae, rather than belonging to the vianine Proserpininae.

In addition, Martin and Harrell collected four specimens of an interesting new *Humboldtiana* from near Victoria, Tamaulipas.

HUMBOLDTIANA PILSBRYI, n.sp. Pl. I, figs. 3, 4

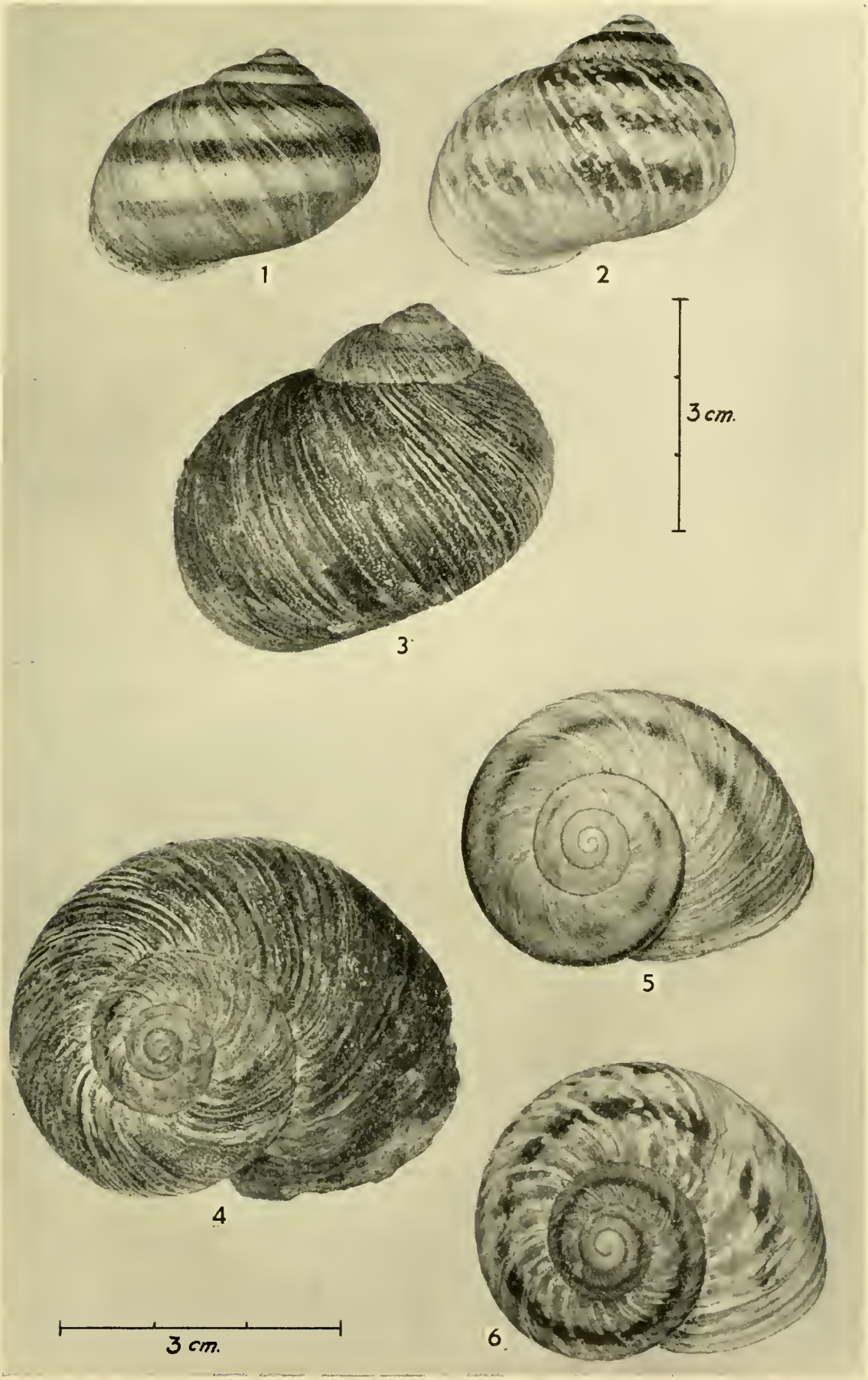
Type: MMZ 181280, collected 2 miles (by road) west of Ojitos Mine, about 4 miles West of Chihue (NW of Victoria), a few miles east of China, Tamaulipas, Mexico. The habitat was a humid pine-oak-madronoyucca forest at 8600′. It was collected at a mouth of a cave February 26, 1953.

Diagnosis: A species of Humboldtiana rather dissimilar to any other Northern Mexican form. It differs from *H. montezuma* Pilsbry mainly in shape and detail of sculpture; from *H. buffoniana* in radular detail, color of animal and shape of shell.

Description: Shell large, somewhat globose, fairly thin; five whorls in largest specimen; first 1¾ whorls embryonic, smooth, shining, maculated with brown and white; angle of spire obtuse, sutures impressed, with sides of whorls somewhat flattened as in *H. nuevoleonis;* sculpture consisting of numerous prominent growth wrinkles and many granulations, in number from one to three per millimeter, in shape from round to oval; granulations usually whitish and scattered over both the growth wrinkles and interstices, being very similar to *H. buffoniana* (Pilsbry 1927: pl. 13, fig. 1); ground color chocolate, interrupted by several streaks of yellowish brown and numerous short white streaks, which more or less follow the growth wrinkles; color bands lacking, except for single band on spire and penultimate whorl; last whorl descending somewhat in adult; lip little or not expanded; parietal callus thin, whitish; columellar margin reflected over and almost closing umbilicus. Height 48.4 mm.; diameter 49.8 mm.; height of aperture 41.2 mm., diameter 30 mm.

Paratypes: UMMZ 181281; two specimens from type locality; one young specimen and a worn adult measuring 55.8 mm. in diameter and 54.7 mm. in height.

Animal: A fourth juvenile specimen preserved in formalin contained the animal. Although too young to yield genital characters, the jaw and radula were extracted and a few notes taken on body color. Back and sides of animal dark grey becoming lighter posteriorly; margins of foot grey, but sole reddish-grey as are mantle lappets. Jaw small and close to that of



FIGS. 1, 5. *Humboldtiana nuevoleonis.* FIGS. 2, 6, *H. durangoensis.*
FIGS. 3, 4, *H. pilsbryi.*

H. ultima figured by Pilsbry (1927: 167, fig. 1d). Radular teeth like those of *H. chisosensis* (Pilsbry 1927: 169, fig. 5).

Discussion: The radular difference, color of the animal, higher spire and flatter outline of the shell serve to distinguish this form from *H. buffoniana.* The maculated embryonic whorls, fewer and shorter white streaks, flatter whorls and different sculpture separate it from *H. montezuma.* In many ways it appears intermediate between the two.

I take great pleasure in naming this species for Dr. Henry A. Pilsbry, not only for all the work he has done on this group, but in appreciation of all the help he gave me when I was in Philadelphia.

A number of specimens of Oleacinidae are not reported on at this time, but are held pending comparisons with type specimens and consultation with authorities on this group.

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A LONG FORGOTTEN SHELL, DELPHINULA LAXA SAY

By H. A. PILSBRY

On plate 7 of his *American Conchology,* Thomas Say figured a remarkable shell with uncoiled whorls, which he described in 1827 (Jour. Acad. Nat. Sci. Philadelphia **5**: 207) as *Delphinula laxa.* The greatest breadth of this shell, he wrote, is about nine-tenths of an inch. It had been found by Stephen Elliot of Charleston on Sullivan Island, South Carolina. Say's figures were copied by Chenu, 1859, Manuel de Conchyliologie **1**: 356, fig. 2635. We reproduce them in figure 1.

Fig. 1. Reproduction of Say's figures of *Delphinula laxa.*

In his remarks Say asks "Can this be a monstrosity of a Natica?" This possibility recommended itself to Dr. William H. Dall, who referred to it as "a deformed Lunatia" in the Blake Report (Bull. 18, M.C.Z., p. 277, 1887). Tryon in 1880 (Man. Conch. 2: 213) included it in *Separatista,* but he suggests that it may rather be a valve of *Diceras.* Possibly *D. laxa* may be a species of Gabb's genus *Laxispira,* known from casts in the Upper Cretaceous of New Jersey and also found in European Cretaceous, but this does not seem probable. In 1885 A. E. Verrill described as *Delphinula nitida* a specimen taken between New Jersey and Bermuda in 1423 fathoms (Trans. Conn. Acad.

VI, p. 425, pl. 44, fig. 11). In his Bulletin 37 U. S. Nat. Mus., 1889, Dr. Dall reprinted Verrill's plate and catalogued the species as *Liotia* (*Laxispira*) *nitida*. However, this small (5 mm. long) modern species resembles *D. laxa* Say in little except the wholly detached whorls, and it is probably not related to Say's species or to the Cretaceous *Laxispira* Gabb. Its family relations are uncertain.

Our attention was called to Say's almost forgotten shell by the appearance of an article by Giorgia S. Coen in Natura: Revista di Scienze Naturali Soc. Ital. Sci. Nat. **40**: 46–48 (Milan, 1949). In a box of discarded rubbish of unknown origin Coen found a specimen which he figured and described as a new genus and species, *Soluta persoluta*.[1] The figure he gave of this shell is almost exactly like Say's figure of *Delphinula laxa*, and so far as we can judge by the figures, it may be the same species. Coen evidently did not know of Say's publication, as he did not mention it. He described a second specimen, not completely uncoiled and ribbed, as *Semisoluta subsoluta*.

The occurrence of "*Delphinula*" *laxa* on Sullivan Island may be adventitious. It may be a fossil washed out of some submerged stratum, or it may be a deep water form which got ashore. It may possibly be a scalariform naticid snail, as Say and Dall surmised, though this seems rather uncertain. In any case, those who have opportunity to collect on that part of the coast should be looking out for this long lost shell.

MARINE SHELLS FROM OHIO PRE-COLUMBIAN BURIAL MOUNDS

By HENRY C. SHETRONE[2]

The current resurgence of interest in the Mollusca is of interest both to the specialist and the student of this aspect of natural history. Much additional information as to the life histories of recent mollusks is being recorded, and this in turn is favorably reflected in the study of their fossil predecessors.

[1] Not *Soluta* Lacordaire, 1872 (Coleoptera).

[2] Director Emeritus and Archaeologist, Ohio State Museum.

An additional aspect of the complex likewise is receiving belated attention—the importance of the Mollusca in human economy through time and space. Archaeological exploration of prehistoric habitation and burial sites is disclosing a hitherto unsuspected major reliance of humans, through the ages, on the mollusks as a principal source of food, and on their shells as material for fashioning implements, utensils and ornaments. The occurrence adjacent to seas, lakes and rivers, the world over, of shell heaps and middens, attests indubitably to this thesis. As additional sources of food became available, through agriculture and husbandry, in indirect ratio to the development of literacy, dependence or mollusks and other sea foods decreased. The succulent oyster, clam, scallop and some others, are exceptions to the general trend.

As a matter of course, primitive peoples utilized any or all mollusks native to their respective areas, whether marine, land or fresh-water. In Ohio and adjacent areas of the Ohio valley, on which this study is based, the only mollusks of economic importance were the numerous species of mussels, popularly known as fresh-water clams. In addition to the above-mentioned uses, the fresh-water mussels secrete valuable pearls, some of which may vie with marine pearls in beauty and value. The quest for these jewels obviously was a major activity of the highly evolved Hopewell peoples, since many thousands, usually perforated for stringing as beads and necklaces, have been taken from their burial mounds. These, in fresh condition, must have equaled the proverbial 'king's ransom.'

During the many years' exploration of the ancient burial tumuli by the Ohio State Museum (the writer and his predecessor) many marine shells and artifacts fashioned therefrom were recovered. At the time no attempt was made to identify, but since his retirement as Director this reporter, following a prolonged study, has attempted to do so. Owing to the fact that most specimens were fragmentary, faded, and more or less deteriorated, the task has been difficult. Since presumably only a minor percentage of all shells possessed by these so-called moundbuilders would be deposited in the burial mounds, they doubtless utilized many additional species from corresponding areas of occurrence. It is interesting to note that all marine

shells from the mounds are univalves, and that apparently they all came from Florida and Gulf stations, indicating that trade and barter of the Ohio tribesmen was with the south.

In the interest of approximate dating, the following kinds or cultures of Ohio aborigines are recognized:

The Early Hunters, tribes from Asia following the big game southward with the recession of the most recent glacial retreat, 10,000–15,000 B.C.

Archaic Man, river dwellers, subsisting mainly on river mussels, 3,000 to 5,000 B.C. Neither of these cultures had other than local shells.

The Adena people, residing in the Ohio valley during the first millennium prior to 1,000 A.D. They constructed impressive burial tumuli.

The Gravel Kame culture, perhaps later than the Adena; they buried their dead in the gravel kames of western Ohio and eastern Indiana.

The Hopewell people, perhaps 1,000–1,500 A.D., were a highly cultured group, possessing many materials including marine shells from distant sources of supply. They erected impressive burial mounds and earthworks.

The Fort Ancient culture, proto-historic, living in Ohio perhaps until the coming of white traders. Village-dwelling, not highly cultured.

The absence or presence of marine shells and other materials from distant sources of supply may be taken as an index to the culture status of a given people. The presence of such materials is evidence of the existence of trade and barter, the genesis of commerce.

Ten species of marine mollusks, representing seven genera, have been tentatively identified. They are as follows:

Busycon contrarium Conrad. This shell was by far the most important in the economy of the Ohio aborigines. Its availability and large size adapted it admirably for fashioning containers, dippers, pendants and smaller artifacts. It has been found in all typical Hopewell tumuli, and occurs sparingly in Fort Ancient sites. Several large beads and an animal effigy, apparently fashioned from *Busycon contrarium* shell, were found in a mound of the Adena culture. This perhaps is the earliest record for Ohio.

Busycon carica Gmel. This large univalve shell is listed

under the old name '*Fulgur*' as having been found in a Hopewell mound.

Cassis madagascariensis Lam. Single specimens in the form of containers were found in two different mounds of the Hopewell culture.

Cassis tuberosa Linné. An artifact fashioned from the outer lip of this species was found in a Hopewell culture tumulus.

Fasciolaria gigantea Kiener. Single specimens of the giant band shell were found in two different Hopewell culture mounds.

Cypraea exanthema Linné. A single example of this cowry comes from a Hopewell culture mound.

Oliva sayana Ravenel. Specimens of this olive were found in a Hopewell mound, and a single one in a village site of the Ft. Ancient culture.

Olivella mutica Say; *Neritina virginea* Linné, and *Marginella apicina* Menke. Specimens of these three so-called 'embroidery shells,' occurred freely in most of the typical Hopewell tumuli. Ends or sides were ground or punctured to admit of stringing for necklaces.

Since all species referred to are widely known and familiar to all students of western Atlantic mollusks, technical references would be superfluous. Suffice it to say that the author, in addition to personal collecting, has studied museum collections and available literature.

COLLECTOR'S ITEMS FROM COMMERCIAL FISHING GEAR

By LELA M. GRIFFITH

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To us commercial fishing has always had an important by-product—mollusks and other forms of life from deep water. Our shell collection was actually started, not with shells gathered on the beach and not even with mollusks, but with two species of Brachiopoda snagged on trolling gear some years ago. They were taken in Sechelt Inlet and brought home as curiosities,

later to be identified as *Laqueus jeffreysi,* a smooth round brownish lamp shell, and *Terebratalia transversa,* quite heavily ribbed and of a reddish color, each attached to a sponge by a peduncle or stalk. We still have them and to this modest beginning have added from time to time all that our own gear brought up and all that we could persuade anyone else to save of deep water material.

It is not quite accurate to say the shells were snagged on the gear although once in a while a scallop closes on a hook. What the hook catches as it is hauled along the bottom is much more likely to be a sponge or bryozoan which in turn often brings up the rock to which it adheres; and either the sponge or the rock may carry a variety of shells and other small creatures.

The population of one more or less typical rock consisted of the following assortment: four bryozoans of three different species, one Snake's Head Lamp Shell (*Terebratulina unguicula*), one Little Lamp Shell (*Platidea aneminoides*), two Ridged Clams (*Humilaria kennerleyi*), one Horse Mussel (*Modiolus modiolus*), three Hairy Snails (*Trichotropis cancellata*), one Lyon's Shell (*Lyonsia pugetensis*), and two corallines (*Balanophyllia elegans*). These ranged in size from a three inch bryozoan to a Platidea no bigger than the head of a pin. Naturally a good many rocks and sponges are barren, and not all types of fishing gear have hooks, but each has contributed, at one time or another, something besides the commercial product for which it is used.

Aside from those already mentioned we have had few shells of any value from trolling gear but did pick off kelp, dragged from six fathoms near Grant Reef in the Gulf of Georgia, a tiny pearly *Cypraeolina pyriformis,* a snail shaped like an infinitesimal cowry, and one *Clinocardium californiense,* a small cockle with more and finer ribs than the common Basket Cockle.

Seines and gill-nets with their too-large mesh are poor equipment for collecting shells but sometimes they bring up mud and debris, embedded in which there may be specimens. From such a source have come some interesting species, particularly small round mussels (*Modiolaria nigra obesa*), each in its protecting gob of jelly. These came up in a gill-net in Rivers Inlet. Also from a gill-net but off the Point Grey Flats we obtained a fine

little Moonsnail (*Polinices pallida*) and a Bent-Nosed Clam (*Macoma nasuta*) ; and in Johnstone Straits a Chinese Hat Snail (*Calyptraea fastigiata*) like a conical limpet outside but with a spiral deck inside. These were attached to kelp holdfasts which came aboard in the net. Here in Jervis Inlet a gill-net inconveniently sank when its floats water-logged, but to make up for the trouble it caused it brought up our first *Cidarina cidaris,* pearly little turbans with spiral rows of beading; and several more of the brown lamp shells (*Laqueus jeffreysi*).

Seines have not yielded much—one hairy brown Horse Mussel (*Modiolus modiolus*) and from Deserted Bay in Jervis Inlet, a number of long slim Jack-Knife Clams (*Solen sicarius*).

Last year a friend gave us a fine big scallop (*Chlamys caurina*), the only perfect specimen we have of this species. Her son brought it home after working on a bottom-dragger in Hecate Strait several years ago. These shells, much sought after by collectors, are commonly taken, I believe, in trawls but, unfortunately, we do not know nor have we been able to contact any trawlers.

Shrimp traps "catch" no bivalves but snails are sometimes attracted by the smell of the bait intended for the shrimps. From traps put down in a depth of nearly one hundred fathoms in the vicinity of Cortez Island we had a donation of nine specimens of *Neptunea phoenicia,* large handsome brown snails with distinct spiral ribs. And from the same source but taken in Bute Inlet, we obtained one huge Ridged Whelk (*Neptunea lirata*)—bigger and handsomer even than its aforementioned cousin. Shrimp traps in seventy fathoms of water off Shannon Creek in Sechelt Inlet invariably bring up a quantity of *Colus morditus* and *C. jordani* more or less evenly divided as to numbers. They are smooth brown snails, one to one-and-a-half inches, usually partially covered with a black growth and rather difficult to tell apart. With them once was the larger more distinctive *Colus herendeeni,* with fine spiral lines and a thin olive-brown periostracum. After these aristocrats the take in Jervis Inlet has not been very spectacular—mostly the large hairy Oregon Tritons (*Argobuccinum oregonense*) with sadly worn apexes from being dragged by their owners over rocky

bottom, the lowly black Spindle Shells (*Searlesia dira*), and a few all-too-common Dog Whelks (*Nassarius mendicus*).

Although there is no commercial crab fishing in this Inlet we have tried crab traps for snails but with very indifferent success. We are too near the Skookumchuck and the strong tide fouls the buoy line and finally it breaks thereby losing the trap. The odd times it came safely up we got mostly the same old Spindle Shells and Dog Whelks but it did secure one prize, the lovely little Spotted Top Shell (*Calliostoma variegatum*), and one *Puncturella cucullata,* a limpet-like shell with sharp ridges and a slit at the apex of the cone.

Cod hand lines have supplied us with several scallops each year. Three species are in the Inlet—*Chlamys hindsii, C. hindsii kincaidi* and *C. hericius*—all in varying shades of pink and all very beautiful. The first two kinds are about two to two-and-a-half inches across, the last mentioned a bit larger and more vividly colored with coarse spiny ribs. These are swimming shellfish and when a line drags between the valves they immediately snap shut instead of prudently backing off. Sometimes from the stomachs of the cod we get the Ribbed Top Shell (*Calliostoma costatum*), the outside layer of the shell dissolved away by the action of the stomach acid leaving the pretty pink and blue pearl exposed. Once, in an urn-shaped sponge stuck on the hook, we found a young Octopus (*Polypus hongkongensis*).

The set-line or long line has been by far the most prolific producer of shells etc. It may be from one hundred fathoms to a mile in length, lies on the bottom with short ganglings at regular intervals each bearing a hook; perhaps a thousand on a mile of line. It is lifted by a buoy line and drags a bit on the sand or rock as it is pulled, the empty hooks catching this and that as they go by. At least it used to work that way. For two or three years now there has been little market for dogfish livers and hence, to our intense regret, no set-line fishing. However, we have had over the years a prodigious haul.

Many of the species from other gear also showed up from the set-line. A few each, *Cidarina cidaris, Calliostoma variegatum, Puncturella cucullata, Colus morditus* and *C. jordani, Modiolus modiolus,* one only *Colus herendeeni,* and one *Polypus*

hongkongensis, the latter from the stomach of a dogfish. A good many each of *Argobuccinum oregonense, Searlesia dira, Nassarius mendicus, Laqueus jeffreysi,* about a dozen *Neptunea phoenicia.* Always a fair supply of the three scallops (*Chlamys hindsii, C. hindsii kincaidi* and *C. hericius*)—one notable contribution of nine specimens, seven *C. h. kincaidi* and two *C. hericius,* these last two from the stomach of a large red anemone —all taken at the same time from approximately the same spot.

The list of those pecliar to the set-line is quite impressive. A tiny brown limpet making its home on kelp, *Acmea instabilis; Lepeta concentrica,* small whitish and limpet-like with faint striations and the periostracum eroded away at the apex; *Solariella peramabilis,* a pearly turban looking like a small tube wound round leaving an open umbilicus; the common little Checkered Littorine (*Littorina scutulata*); the White Slipper Shell (*Crepidula nivea*) oval, clinging flatly, pearly inside with a deck squarely across one end; *Melanella comoxensis,* tiny pink-spired snails (our specimens were picked off an old shoe); *Ocenebra fraseri,* a knobby little fellow with a sort of basket-work sculpture; *Trophon tenuisculptus,* similar to the last but longer and slimmer with an elongated and twisted canal; *Olivella boetica,* the Little Olive, purplish and porcellain-like, one only taken off Scuttle Bay; *Siphonaria thersites,* looking like a brown horn limpet but with a slight groove running from the vertex to the margin inside; *Loligo opalescens,* the slim squid with its opalescent hues.

Bivalves, too, are well represented. Two thin white transparent scallops about the size of a finger nail, *Pecten vancouverensis* and *P. randolphi,* the former with a few roughish lines and the latter smooth; two little brown clams, one with heavy concentric ridges, *Astarte alaskensis,* and one with lighter broken ribs, *Astarte esquimalti;* small yellowish Kelly Shells (*Kellia suborbicularis*), two juveniles only we have; *Panomya ampla,* a heavy irregular shell, chalky white in color; *Hiatella pholadis,* an oblong misshapen little clam found burrowed into sponges and in crevices in rocks; the white Ridged Clam (*Humilaria kennerlyi*); *Lyonsia pugetensis,* small slivery and delicate.

To these we add two Brachiopoda, one flat round brown and of very minute dimensions, *Platidea aneminoides,* the Little

Lamp Shell; the other about an inch long, white with fine lines radiating from the area of the beaks, *Terebratulina unguicula.*

In addition to mollusks and brachiopods the set-lines and cod-lines pick up other items which may be of interest. First, two Protozoa hardly large enough to see; a round one looking as if it were made of overlapping plates, *Foraminifera discorbis,* and a slim curved one, *Foraminifera dentalina.*

In the Coelenterata are the very pretty hard little pink "Corals" (*Diaperoecia vancouverensis*); two gorgonian corals, the large spreading fan-shaped structure, soft and brittle, of a gorgeous red color, *Euplexora marki*); and the yellow "Huckleberry Bush," equally large but strong and shrubby, sometimes with a trunk like a young tree, a species of Eunicea. Then there is our only true coral, *Balanophyllia elegans,* called the Cup Coral, quite small round cup-shaped, of a vivid orange hue. Two sea pens are fairly common. *Ptilosarcus quadrangularis* is up to a foot long, the "stem" thick and fleshy, polyps on leaf-like attachments along more than half the length, all bright reddish orange. *Stylatula elongata* is similar in structure but much slimmer, up to six feet long and a pale ivory color.

The most attractive echinoderm is the pale lacy Basket Star, *Gorgonocephalus caryi,* with a very small body but surrounded by many waving arms—the original five each branched twelve times. Another odd starfish is *Ceramaster arcticus,* also pale but flat and almost a perfect pentagon, seemingly with no arms at all. From four hundred fathoms come Heart Urchins (*Lovenia cordiformis*) very spiny and more fragile than the shallow water sea urchins.

A few crustaceans are worthy of note: the Squat Lobster (*Munida quadraspina*) with his short red body and long red legs, not quite a lobster and not quite a crab; the great warty Box Crab (*Lopholithodes foraminatus*) which folds so that his shelly parts fit tightly around openings between the front legs, permitting passage in and out of water currents; the equally large and very similar King Crab (*Lopholithodes mandtii*), distinguished by the lack of the foramen.

Not off the fishing gear but on kelp lifted by the anchor we collected two choice species; from Baker Pass a pair of wee

white Gem Clams (*Gemma gemma*) and from Rivers Inlet one fat brown Chink Shell (*Lacuna porrecta*).

So much for what we have. The fishing season is on again and we anticipate what it will bring—perhaps not much but always the chance of something strange. Perhaps there will be set-line fishing again one day. Perhaps we shall meet a cooperative trawler. And who knows? Perhaps this article will inspire some fisherman to save those oddities that come up on his gear. Of course, there is, too, the dredge, but that is another story.

NOTES ON TEXAS BULIMULUS

By FRANK L. SIMMONS

Odessa, Texas

My observations on the distribution and ecology of Bulimulus relate chiefly to the species of Coryell County, in central Texas, and are the result of only a very few years of observation and collecting.

Bulimulus dealbatus (Say) is found abundantly in Coryell County. It is found on the Leon River flood plain, up the steep hillsides, in the limestone bluffs, and over the hills into the treeless pastures where it is more abundant and most at home. It is found in populous colonies in the high open pasture lands where there is only grass and weed coverage.

It can survive the severest drouths. As I write (Oct. 20, 1953) there has been only 2½ inches rainfall since the great Waco tornado of May 11, 1953, and in turning weed piles and stones around the margin of my garden I find live *B. dealbatus* under them.

This snail is often found by hundreds where it has climbed weeds up 6 inches to 3 feet above soil. It is notable that it always climbs dead, last year weeds. It is subject to attacks of carnivorous animals. I often find large numbers of shells that have been robbed of the animal. Red ants will destroy all in the range of their feeding ground.

Here, in Coryell County in the limestone lands it attains greater size than in clay or sandy soils. To illustrate: a collec-

tion made in an abandoned sand field 6 miles to the southwest, the average height is 19 mm., whereas in a collection made on the high prairie lands approximately 250 feet above the river flood plain the average *B. dealbatus* is globose conic, of 6 convex whorls, the nuclear whorl is often brown or black, height 26 to 28 mm., aperture 12 to 14 mm. high, 10 mm. wide; shell marked with ashen gray streaks and blotches across whorl.

A small collection from Tarrant County, collected on sandy post oak land, averaged 18 mm. high. Another collection from Palo Pinto County, were even smaller, measuring only 18 mm. for the largest. It, too, came from poor sandy post-oak land.

Bulimulus dealbatus mooreanus. These were taken in the massive limestone Culpepper Bluffs half mile west of Mother Neff State Park, Coryell County, Texas, 1951. The bluff is approximately 150 feet higher than the Leon River level below it.

It is capped by 20 to 25 feet of massive limestone. Lower slopes, which are very steep, littered with an abundant forest debris covering, and massive limestone boulders and stones broken off the cliffs above. There is a good growth of ash, elm, buckeye, several species of oak, greenbriar, grape, poison oak and other hillside growths.

In this county, this is a strictly timberland snail. I have never found it removed from good vegetal coverage. Its favorite haunts are the rugged stony hillsides although it may be found on the River flood plain.

It is gregarious, living in large colonies. In this location *B. dealbatus mooreanus* is almost in its pure state, but where there is an overlapping into a colony of *B. dealbatus* (Say) there is apparently extensive hybridization between the two subspecies.

Snails, in Indiana Economy: under the massive capstone mentioned above there are several extensive rock shelters, commonly called "caves," in which primitive man made his home, and in them are many kitchen-middens, the debris deposited where primitive men left the waste materials from their living habits. In March 1952, with my son-in-law and grandson, I excavated a section of midden deposit 24 ft. by 4 to 6 ft. wide and 30 to 36 inches deep.

There were human bones representing three individuals. The bones were in an advanced state of decay. Several bushels of river mussels the greater part of which were in an advanced state of decay. 160 flint artifacts were recovered, but here is my main point—the magnificent *B. dealbatus mooreanus* was well distributed throughout the debris.

I gave my grandson my share of the flint artifacts but I dropped 21 of these fine snail shells in my pocket and saved them, because it struck me very forcibly to observe the human bones and mussel shells in an advanced state of decay and most of the snail shells in good condition. Evidently they were introduced as the midden grew under the occupancy of the people who lived there but they had held form and quality better than bones or mussel shells. Does this indicate that the Indian used the snail to augment his food supply.

Bulimulus schiedeanus pecosensis Pilsbry. This is a fine species known by its long, acute spire, 7 strongly convex regularly increasing whorls, the body-whorl less inflated than in *B. dealbatus*. It was first found in 1852, only 8 specimens under Culpepper Bluff, Coryell County, Texas, near the bank of the creek. I had not seen this snail anywhere else, and recognized it at once as a different species. Dr. Pilsbry has identified it as above, reporting that my specimens are closely like the type lot from the Pecos River.

Since then I had not met with this shell until Mar. 9, 1954. While exploring the craggy limestone bluffs of Horse Creek, two miles down Leon River from Culpepper Bluff, I came upon an excavation five feet deep. Archaeologists had excavated a shell-rock midden five feet deep. I noted that a great quantity of river clams along with a like quantity of snail shells had been thrown from the excavation, and many were sticking in the undisturbed wall. Most of the shells of all sorts were rotten and broken. Of the snails I noted *B. dealbatus mooreanus* Pfeiffer and *B. dealbatus* Say, in large numbers; among them were a great number of my (then) unidentified species. Most of the lot were rotten and damaged; however I collected 19 fairly good *B. s. pecosensis*. This shell has such striking and different characteristics that I believe it is a species in its own right. I have found them only in alluvial creek bank deposits and in

midden deposits, and only in the two locations cited above. I have found no living specimens.

Bulimulus alternatus mariae (Albers): I have not observed this fine shell in Coryell County, nor have I heard of it being found here. Its habitat is chiefly in the Rio Grande plain, that vast low lying area in the southwest known as "the brush country." I have small collections from Cameron County at the extreme southern tip of Texas, from Nueces County, mid Gulf Coast, from Zavala County in the mid brush country, from Willacy County (adjoining Cameron County). These were identified for me by Dr. A. B. Leonard, of Kansas University, Lawrence, Kan.

This is the only bulimulid I have found that has a columellar denticle. On the strong callus near the columellar termination of peristome are one or well defined denticles. Aperture often pinkish purple. Outside marked with brown blotches and streaks running with axis of shell. Length 30 to 32 mm.

MESODON THYROIDUS (SAY) IN FLORIDA

By WILLIAM J. CLENCH

Typical *Mesodon thyroidus* (Say) occurs in peninsular Florida as far south as the Suwannee River system. At the time Pilsbry considered this species in his Monograph (1940, 1, pt. 2, p. 706) it was known to occur "in western Florida, but is not known from the peninsula."

It is still a rare species in the northern portion of the state though unquestionably many more records will come to light when serious collecting is attempted. Its distribution will probably always remain spotted owing to its own ecological demands for rather moist hardwood areas, particularly along stream margins. Even here, it is generally absent because of several other factors which are as yet completely unknown.

A very vigorous colony was found at Oldtown on the banks of the Suwannee River in Dixie County. This locality is about one mile north of the bridge on U. S. Route no. 19. At this point both river and road bend toward each other until they run side by side for a few hundred yards. The bank at this

point is about 20 feet high, tree and brush lined and margined with broken limestone as fill for the road. We first found this colony in 1934 and again this past summer in 1953. Adults were abundant crawling over the rocks and the boles of the small trees, young specimens, about half grown, were found 8 to 10 feet up in the trees on the leaves, a situation I have never observed anywhere else. This record represents the southern most locality in the state of Florida so far as now known.

At Spring Creek, 3 miles southeast of Marianna we found this species to be fairly common along the banks, but not at all abundant. In passing, I would like to mention that this is one of the most remarkable localities for fresh water mollusks. Species are few in number but the abundance of individuals of each species surpasses belief. The Georgia Light and Power Co. have dammed this creek at U. S. 90. The lake above the dam is literally filled with *Goniobasis floridensis* Reeve and *Pomacea paludosa* (Say). Several rowboats had their sides literally plastered with eggs of this latter species, in places over one inch thick. Below the dam, *Elliptio strigosa* (Lea) were so numerous that they had to "up end" themselves in certain spots owing to crowding.

The following are the Florida records of *Mesodon thyroidus* (Say):

Spring Creek, 3 miles southeast of Marianna, Jackson Co.
Alum Bluff, Liberty Co., Apalachicola River.
Torrea Park, 12 miles south of Chattahoochee, Gadsden Co.
Near mouth of Withlacoochee River, Suwannee River, Madison Co.
Near Itchatucknee River, Columbia Co.
Oldtown, Suwannee River, Dixie Co.

THE MOLLUSKS OF BROWN COUNTY, WISCONSIN

By MARGARET C. TESKEY

Since the monumental work of Baker (1928), several short papers by Morrison (1929, 1932), Levi and Levi (1950) and Solem (1952) add additional records to the distribution of Wis-

consin mollusca. This contribution reports the specimens obtained by collecting at 32 stations in Brown County, Wisconsin from October 4th to 19th, 1953. Additional stations which yielded no mollusks were not counted in this survey.

Brown County embraces both shores of the southern end of Green Bay, and except for the city of Green Bay, the village of De Pere and several crossroad hamlets it is given over to the dairy farms for which Wisconsin is famed. The few wooded areas which remain are in nearly every instance pastured and afforded very poor collecting. An attempt was made to give equal attention to these forest areas (if second and third growth woodlots may be so designated), roadside bogs, quarrys both active and abandoned, several creeks, the Fox River (badly polluted by paper mills) and the bay. Considering that this constitutes one of the most "improved" sections of the state, it was a pleasant surprise upon totalling up to be able to record 62 species.

Of special interest was the discovery of *Hendersonia occulta* (Say) at three stations, widely separated and ecologically distinct. In De Pere Township (where Marston collected it in 1890) this species occurred in quantity; three hundred specimens were taken from a woods pool not over ten feet in diameter. In some instances they were wholly submerged, but more often were under the rotted leaves at the very edge of the stagnant water. Later the species was found very much alive in the dry-as-dust detritus on limestone ledges of the escarpment which overlooks Green Bay in the northern section of the county; in this instance no water was in sight other than the bay several hundred feet below and a mile distant, nor was there evidence of spring or seepage water in the vicinity. The third location was the shoulder of a secondary road miles removed from the other two colonies. This time the snails were under loose gravel which in turn was drifted over with recently-fallen leaves.

Finding *Pomatiopsis lapidaria* (Say) on a baked forest floor (Wisconsin had suffered from a summer-long drought) was a shock to this collector who had heretofore associated the mollusk with the spray-drenched rocks at the base of Niagara Falls.

Acknowledgment is hereby made of the kindness of Rev. H. B. Herrington who identified the Sphaeriidae, of Dr. Henry van

der Schalie who determined the mussels, and especially that of Mr. Alan Solem who with great patience identified the mass of land and fresh water gastropods.

Following is a list of the species taken, together with the number of stations at which they occurred. The mussels in all cases were beach specimens. No attempt was made to collect slugs, which were infrequently encountered.

Hendersonia occulta (Say) (3)
Stenotrema monodon (Rackett) (2)
S. fraternum (Say) (4)
Allogona profunda (Say) (7)
Mesodon thyroidus (Say) (3)
Triodopsis multilincata (Say) (3)
Euconulus fulvus (Müller) (2)
E. chersinus golygratus Pils. (1)
Retinella electrina (Gould) (2)
R. indentata (Say) (2)
Hawaiia minuscula (Binney) (2)
Zonitoides arboreus (Say) (12)
Z. nitidus (Müller) (2)
Striatura milium (Morse) (1)
Anguispira alternata (Say) (8)
Discus patulus (Deshayes) (1)
D. cronkhitei anthonyi (Neweomb) (7)
Helicodiscus parallelus (Say) (5)
Punctum pygmaeum (Drap.) (1)
Gastrocopta pentodon (Say) (1)
G. holzingeri (Sterki) (4)
G. contracta (Say) (6)
G. armifera (Say) (6)
Vertigo ovata (Say) (3)
Strobilops affinis Pilsbry (1)
S. labyrinthica (Say) (6)
Vallonia pulchella (Müller) (3)
V. costata (Müller) (2)
Cionella lubrica (Müller) (1)
Succinea ovalis Say (9)
S. avara Say (7)
Oxyloma retusa (Lea) (6)

Carychium exiguum (Say) (6)
**Limnaea palustris* (Say (8)
L. palustric (Say) form *exilis* Lea (2)
L. caperata Say (6)
L. humilis Say (1)
Gyraulus deflectus (Say) (7)
G. parvus (Say) (1)
Planorbula armigera (Say) (5)
Helisoma anceps (Menke) (1)
H. trivolvis (Say) form *megasoma* DeKay (2)
Physa sayii Tappan (8)
Aplexa hypnorum (L.) (8)
Viviparus malleatus (Reeve) (1)
Campeloma rufum Haldeman (2)
Bulimus tentaculatus (L.) (1)
Pomatiopsis lapidaria (Say (1)
Pleurocera acuta Rafinesque (1)
Goniobasis livescens (Menke) (3)
Pisidium casertanum (Poli) (1)
Sphaerium sulcatum (Lam.) (1)
S. striatinum (Lam.) form *solidum* Prime (1)
S. occidentale Prime (6)
S. (Musculium) securis (Prime) (2)
Lasmigona complanata katherinae Lea (1)
Fusconaia flava parvula Grier (1)
Elliptio dilatatus sterkii Grier (1)
Leptodea fragilis lacustris F. C. Baker (1)
Anodonta grandis footiana Lea (1)
Lampsilis siliquoidea rosacea DeKay (1)
Amblema costata plicata Say (1)

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* In grouping the seventeen lots of Lymnaeidae into three species and one variety, Mr. Solem followed Hubendick (1951).

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A NEW SUBSPECIES OF TRIODOPSIS FALLAX (SAY)

By LESLIE HUBRICHT

Triodopsis fallax affinis, new subspecies

Shell depressed, with dome-shaped or conoidal spire, deep olive-buff to wood brown, narrowly umbilicate, the umbilicus contained about 10 times in the diameter of the shell. Whorls 5.3 to 6.2, closely coiled, with the periphery above the middle, deeply constricted behind the peristome. First whorl smooth, later whorls with fine spiral striae below the suture. Reflected peristome white, thickened within, with a pointed to rounded, inwardly bent tooth in the outer margin, and a transverse tubercle on the callus ledge in the middle of the basal margin. Parietal tooth rather long and angularly curved to arcuate. There is no internal tubercle on the columellar axis.

Diam. 12.2 mm.	Ht. 7.7 mm.	6.0 whorls.	Holotype.
Diam. 12.6 mm.	Ht. 7.8 mm.	6.2 whorls.	Paratype.
Diam. 10.5 mm.	Ht. 6.2 mm.	5.6 whorls.	Paratype.
Diam. 9.1 mm.	Ht. 5.3 mm.	5.3 whorls.	Danville.
Diam. 13.3 mm.	Ht. 8.0 mm.	6.0 whorls.	Calhoun Falls.

Triodopsis fallax affinis differs from *T. fallax fallax* (Say) in the absence of the internal tubercle, also the spire averages higher, the umbilicus smaller, and the tooth on the outer lip smaller, and less inflected. From *T. fallax alabamensis* (Pils.) it differs in its smaller umbilicus and higher spire.

The range of *T. f. affinis,* is mainly south and west of typical *fallax,* extending from Virginia, through the western Piedmont of North Carolina, into Georgia. Along the zone of contact

there are some hybrid colonies, as at Eau Clair, Union, Clinton, and Spartanburg, South Carolina, Elkins, North Carolina, and Danville, Virginia. At these localities some specimens have a well developed internal tubercle, some have none, and others are intermediate. At Danville, Virginia there is also a distinct difference in size between the two subspecies, *affinis* being quite small.

In western South Carolina *affinis* grades into *T. f. alabamensis, T. f. alabamensis* being found at Anderson, and Pendleton, in Anderson Co., and at Seneca and Westminster, in Oconee Co.

Specimens from Danville, Virginia have been identified as *T. vannostrandi alabamensis* (Nautilus **64**: 8), and although they are similar to some Alabama shells they are not typical *alabamensis,* and because of the wide geographical separation it seems best to place them under *affinis.*

The only difference in the shell between *T. messana* Hubricht and *T. f. affinis* is in the color. But at Columbia, South Carolina, where *affinis* has come in contact with *T. hopetonensis,* it has hybridized freely with it, which *T. messana* will not do, indicating a fundamental difference between the two species.

Localities.—Virginia: Pittsylvania Co.: along Riverside Drive, Danville; along Cascade Creek, 2 miles south of West Fork. North Carolina: Wake Co.: clearing, 0.5 mile southeast of Garner. Guilford Co.: oak woods, along US-29, 6 miles northeast of Greensboro. Rockingham Co.: upland woods, 3.5 miles southwest of Madison; Mayodan. Stokes Co.: summit of Hanging Rock Mtn., Hanging Rock State Park. Surrey Co.: Elkins. Wilkes Co.: North Wilkesboro. Alexander Co.: Stony Point. Caldwell Co.: Lenoir; Hudson; Granite Falls. McDowell Co.: Marion. Gaston Co.: Cherryville. South Carolina: Spartan burg Co.: Spartanburg; Woodruff. Cherokee Co.: Gaffney. Greenville Co.: Greenville; Piedmont; 1 mile west of Greer. Union Co.: Union. Laurens Co.: Clinton; Gross Hill; Laurens; Enoree. Anderson Co.: Honea Path; Belton; Williamston. Abbeville Co.: Abbeville; Due West; Donalds; Calhoun Falls. Greenwood Co.: Ninety Six; Greenwood. Newberry Co.: Little Mountain; Prosperity; Whitmire. McCormick Co.: McCormick. Saluda Co.: Ward; Saluda. Edgefield Co.: Edgefield. Richland Co.: Eau Clair; waste ground, Huger and Richland Sts., Columbia, holotype 191307 and paratypes 191308 A.N.S.P., paratypes 11451, collection of the author. Lexington Co.: Batesburg; West Columbia; Lexington; Irmo; Cayce. Georgia: Hart

Co.: roadside, 6 miles east-northeast of Hartwell; Hartwell. Franklin Co.: Royston. Barrow Co.: Winder. Wilkes Co.: Washington. Lincoln Co.: upland oak woods, 4.5 miles southwest of Lincolnton.

THE LAND SNAILS OF HENRICO COUNTY, VIRGINIA

By JOHN BAYARD BURCH

University of Richmond

Henrico, one of the smaller counties of Virginia, has an area of 234 square miles. It is situated just east of the center of Virginia, and has an elevation varying from tide water, in the southeastern part, to above 260 feet in the northwestern part. The greater portion of the county is from 150 to 250 feet above sea level. The northern boundary is formed by the Chickahominy Rivery, arising in the northwest corner and flowing into the James River below Charles City. The southern boundary is formed by the James. Numerous small streams drain the county, flowing into these two rivers. The western two-thirds of the county is a part of the Piedmont Plateau physiographic province, the eastern part belonging to the Coastal Plain.

Several of the land Mollusca of Henrico County were listed by Dr. Paul R. Burch in his article "Mollusks" in the Virginia Academy of Science publication *The James River Basin, Past, Present, and Future* in 1950. These included the snails *Discus patulus* Deshayes (not found by the author), *Haplotrema concavum* (Say), *Mesodon thyroidus* (Say), *Stenotrema hirsutum* (Say), *Triodopsis fallax* (Say), and *Ventridens* (= *Zonitoides*) *arboreus* (Say). Two additional species, *Helicodiscus parallelus* (Say) and *Retinella indentata* (Say), were reported by personal communication. *Triodopsis obsoleta* (Pilsbry) was listed by Hubricht (1953) as being an introduced form in Richmond but specimens have not been found by the author. Dr. Henry A. Pilsbry (1939–48) does not list any snails from Henrico County in his *Land Mollusca of North America* (*North of Mexico*).

The land snails are represented in Henrico County by eight families. Twenty-four species and subspecies are listed in this paper. Their distribution seems to depend on the availability of calcium compounds, organic material upon which to feed, moisture, and cover.

Carychiidae

Carychium exiguum (Say). Generally distributed under and among decaying leaves in damp places, but not common.

Pupillidae

Columella edentula (Draparnaud). Numerous specimens found near White Oak Swamp Creek, VA. 717; Willis' Church, VA. 156; and White Oak Swamp Creek, VA. 156. In most cases this species was found under and among decaying maple, sweet gum, and oak leaves.

Gastrocopta contracta (Say). This species is fairly common throughout the county. It is usually found around or under the bark of damp hardwood logs and stumps, and in all cases has been found associated with forested stream valleys.

Gastrocopta pentodon (Say). Found only at the old coal mine on Gayton Road, VA. 706.

Pupoides albilabris (C. B. Adams). Found only near White Oak Swamp Creek, VA. 802 in and around decaying oak and maple stumps.

Succineidae

Succinea aurea (Lea). Found in the central part of the county along the James River. This species is generally picked up from rocks near the waters edge. Not common.

Endodontidae

Anguispira alternata angulata (Férussac). Generally distributed over the northern and western parts of the county, but most common along the Chickahominy River lowlands. This species has been found associated with a variety of hardwoods.

Helicodiscus parallelus (Say). Very common throughout the woodland areas. It is found most common in hardwood forests. Exceeded in abundance only by *Zonitoides arboreus*.

Zonitidae

Hawaiia minuscula (Binney). Found along the James River lowlands in the eastern part of the county and around the masonry of St. James Baptist Church, VA. 5.

Retinella indentata (Say). In small numbers in scattered localities throughout the county, but not very common.

Striatura milium (Morse). Several specimens occurred in lots collected near Short Pump, U. S. 250.

Ventridens ligera (Say). Not common. Found on VA. 605 near the James River, Wilton Creek, VA. 611, and near Laurel Pond, on Hungary Creek, U. S. 33.

Ventridens suppressus magnidens Pilsbry. Generally distributed over the county but not altogether common. It has been found in a variety of habitats, from under hardwood logs to around stone masonry in urbanized areas.

Zonitoides arboreus (Say). This species is probably the most common land snail found in the county in both number of specimens and distribution. It is not restricted to woodlands and it apparently has no preference to any particular hardwood.

Strobilopsidae

Strobilops aenea Pilsbry. Found predominately under the bark of oak logs. This species is fairly common in the county.

Strobilops labyrinthica (Say). Generally distributed but not as common as *S. aenea*. These two species are sometimes found together.

Haplotrematidae

Haplotrema concavum (Say). Extremely common, being found wherever the habitat is favorable for other snails.

Polygyridae

Mesodon appressus sculptior Chadwick. This snail was found from only one locality in Henrico County, James River, VA. 605, but has been found commonly along the cliffs on the Chesterfield County side of the James River.

Mesodon thyroides (Say). This is a common snail in the Piedmont division, prevailing along the James River. It is most generally associated with woodlands having a predominance of oaks.

Stenotrema hirsutum (Say). Found only in the woods surrounding Westhampton Lake, University of Richmond, but very common here. These individuals comprise a small race, averaging somewhat less than 7 mm. in diameter.

Triodopsis albolabris (Say). Generally distributed over the county but not very common.

Triodopsis fallax (Say). Abundant in the central part of the county. This species is generally found around dwellings and gardens and is seldom found associated with hard or softwoods.

Triodopsis hopetonensis (Shuttleworth). Found only in the southeastern tip of the county in the James River lowlands.

Triodopsis tridentata juxtidens (Pilsbry). Abundant over the entire county. Unlike *T. fallax,* this species is generally restricted to the woodlands.

Acknowledgments

I wish to thank Dr. Henry A. Pilsbry, Curator of Mollusks, Academy of Natural Sciences of Philadelphia, for identifying *Ventridens suppressus magnidens* Pilsbry, Dr. J. P. E. Morrison, Associate Curator of Mollusks, U. S. National Museum, for identifying *Retinella indentata* (Say), and Dr. Paul R. Burch, Professor of Biology, Radford College, Virginia Polytechnic Institute, for identifying *Triodopsis hopetonensis* (Shuttleworth).

Literature Cited

Burch, Paul R., 1950: "Mollusks," The James River Basin, Past, Present, and Future, James R. Proj. Comm., Va. Acad. Sc., pp. 129–137.

Hubricht, Leslie, 1953: Land Snails of the Southern Atlantic Coastal Plain, The Nautilus, vol. 66, no. 4, pp. 114–125.

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NOTES AND NEWS

Dates of The Nautilus.—Vol. 67, no. 1, pp. 1–36, pls. 1–4, was mailed July 24, 1953. No. 2, pp. 37–68, pls. 5, 6, Nov. 11, 1953. No. 3, pp. 69–104, pls. 7, 8, Feb. 18, 1954. No. 4, pp. 105–140, i–v, pls. 9, 10, May 17, 1954.—H. B. B.

HOLOSPIRA RIOGRANDENSIS Pils., described in 1946 from specimens found by Jas. H. Ferriss, has been taken again. These are from a bluff on the north side of the Rio Grande, at mouth of Santa Elena canyon, Big Bend National Park, southeastern Brewster Co., Texas. They were collected by Mr. John Twining and transmitted to me by Prof. H. B. Stenzel.—H. A. PILSBRY.

A NEW RECORD OF AN ALBINO OLIVE.—A perfect albino specimen of *Oliva incrassata* Sol. was taken in the Gulf of California recently. The mollusk was found alive on a sandbar at low tide about two miles north of San Felipe, Baja California, on the afternoon of February 22, 1954.

The animal was discovered in a characteristic mound of sand in which individuals of this species conceal themselves when exposed by the ebbing tide. The white mantle of the mollusk completely encircled the shell at the time of its capture, but was quickly withdrawn, revealing that both the animal and the shell were pure white.

The shell measures 44 mm. in length and 22 mm. in width. It has a sharp apex and the fine naturally glossy surface normal to the genus. The shell is a brilliant opaque porcelain white, without a trace of any color.

Among the other individuals of this species obtained from San Felipe are some golden varieties. A few are gold colored, without the usual markings and flecks, these being juveniles.

The albino and golden *Oliva incrassata* will be exhibited by Dr. Howard R. Hill of the Los Angeles County Museum at the American Malacological Union Convention at Durham, New Hampshire, in August.—MRS. MILTON W. ZIM, Pacific Shell Club, Los Angeles, California.

CORRECTIONS AND ADDITIONS to "The Terrestrial and Aquatic Mollusca of Albany County, Wyoming."—The collections of *Pisidium* mentioned in the paper had been determined at the Chicago Museum as *Pisidium contortum* Prime and were so listed.

This winter Reverend H. B. Herrington has had my entire collection of *Pisidium*. He writes that all of the *Pisidium* from Albany County are *P. casertanum* Poli, not *P. contortum*. Also one lot of dead shells sifted from the sand in the Laramie River

at Laramie contained several shells of *P. compressum* Prime. These had been washed down from the Medicine Bow Mountains in the county, but their exact point of origin is uncertain.

Due to the mild winter I have been able to do some outdoor work and have found *Valvata sincera* Say in the Little Laramie River near Quaely.

Corrections in the paper should be made as follows:

Add *Valvata sincera* Say and *Pisidium compressum* Prime to the species list, p. 125.

Change *Pisidium contortum* to *P. casertanum* Poli.

Middle Fork of Crow Creek, *P. casertanum,* p. 128.

Blair Picnic Ground, *P. casertanum.*

Pole Mt., S. Fork of Pole Creek, *P. casertanum.*

Horse Creek, *P. casertanum.*

North Sibille Creek, *P. casertanum.*

Spring Creek, *P. casertanum.*

Laramie River at Laramie, *P. compressum, P. casertanum.*

Little Laramie River at Centennial, *P. casertanum.*

Little Laramie River near Quaely, *Pisidium casertanum, Valvata sincera.*

Camp Roosevelt on Pelton Creek, *P. casertanum.*

Middle Fork of the Little Laramie River, *P. casertanum.*

Brooklyn Lake, *P. casertanum.*

Telephone Lakes, *P. casertanum.*

Thanks are due to the Reverend H. B. Herrington who has identified my Sphaeriidae, p. 128.

DOROTHY E. BEETLE

PUBLICATIONS RECEIVED

AMERICAN SEASHELLS. By R. Tucker Abbott, B.S., Division of Mollusks, U. S. National Museum, with illustrations by Frederick R. Bayer, B.S., Van Nostrand Co., Inc., New York, Pp. xiv + 541, 40 plates, many text figures.—It is the aim of this book to give the student a well rounded knowledge of mollusks, the first 70 pages being occupied by chapters relating to how these animals live, feed and mate, how to collect them, and how to go about their study. The descriptive chapters following

describe most of the shells likely to be found along our shores, no less than 1500 being described and beautifully illustrated. Many minute shells and those of deep water could not be treated fully in the limits of one volume.

Advanced students and expert malacologists will find the book equally useful for reference as its arrangement embodies the latest taxonomic studies, and it contains numerous changes from current nomenclature only recently adopted or in some cases not published elsewhere.

We are not enthusiastic over the use of "common" names. Vernacular names are actually in use for conspicuous shells and those of economic value. Many in use, such as "paper fig" or "micremoc" (*Cypraea cervus*) are not adopted in this book. But to make up names for every insignificant periwinkle seems to us of little use. The precedence given these names in the explanations of plates is rather confusing, since a large proportion of them are practically new names.—H. A. P.

Waves and Tides. By R. C. H. Russell, M.A., and Commander D. H. Macmillan R.N.R. Philosophical Library, N. Y. 348 pages, over 100 line drawings and photographs. Everyone interested in the sea is concerned with waves and tides. The many problems of wave form and action and the theory and the complications of tidal phenomena are presented here in clear, non-technical language. It can be read with pleasure by all whose occupation or diversions take them on the sea.—H. A. P.

Between the Tides. By Philip Street, M.Sc., F.Z.S. Philosophical Library, Inc., 75 E. 40th St., N. Y. 16, N. Y. 175 pp., profusely illustrated with photographs. Though this book is intended primarily for young naturalists, it is not written down to them and the chapters on seaweeds, crabs, mollusks, the plankton and others, give a great deal of essential information in very readable form. The illustrations from photographs by the author are extremely good. The drawback for American readers is that it is based upon the animals and plants of British shores, many of them unlike anything to be found on our coast, but not the less interesting.—H. A. P.

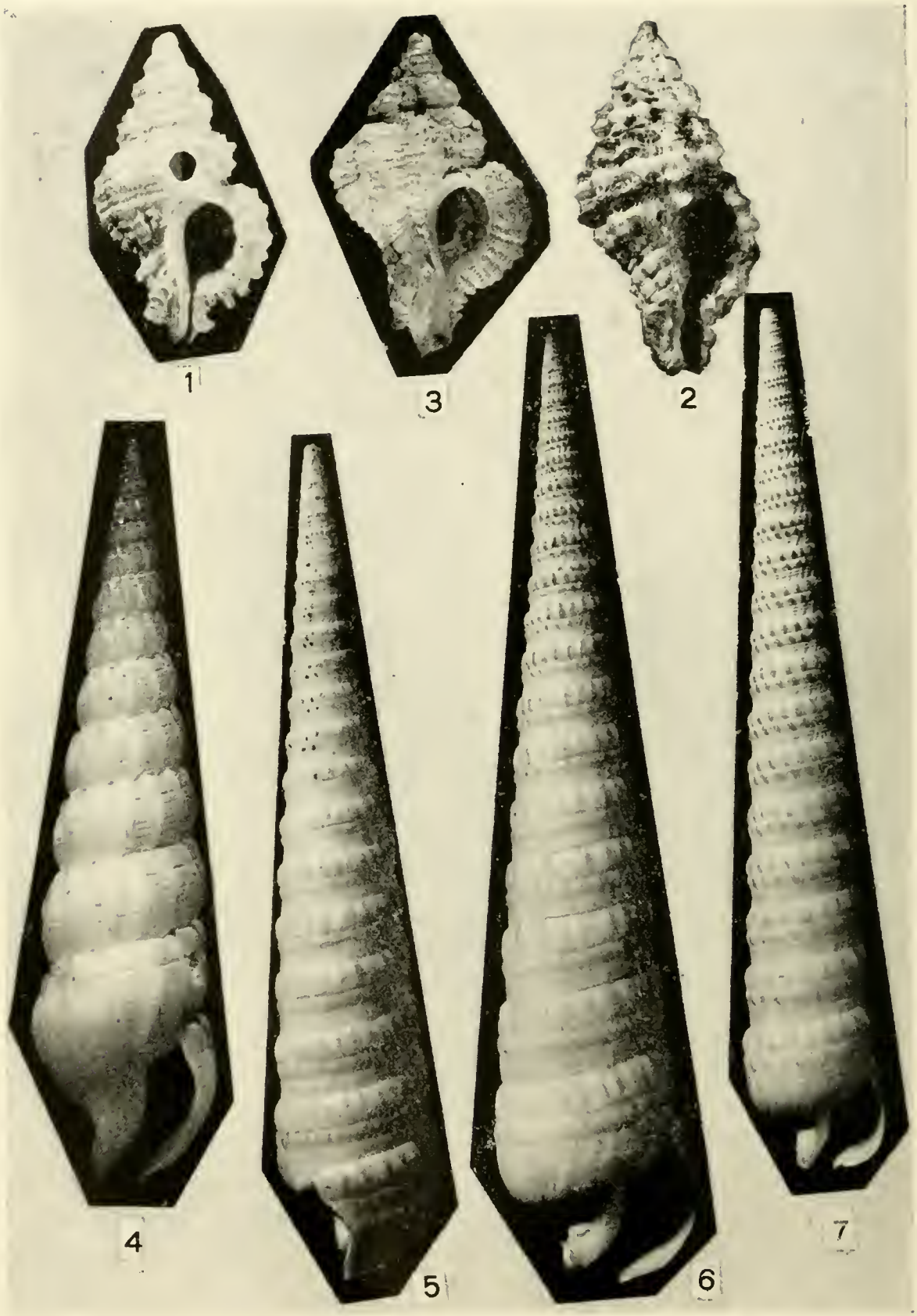

FIG. 1, *Ocenebra minirosea* Abbott, holotype. FIG. 2, *Ocenebra muricoides* C. B. Adams [holotype of *Tritonalia caribbaca* Bartsch and Rehder]. FIG. 3, *Ocenebra emipowlusi* Abbott, holotype. FIG. 4, *Terebra arcas* Abbott, holotype. FIGS. 5–6, *Terebra floridana stegeri* Abbott, (fig. 5) paratype; (fig. 6), holotype. FIG. 7, *T. floridana* Dall (off Sambo Reef, Fla.).

THE NAUTILUS

Vol. 68 OCTOBER, 1954 No. 2

NEW GULF OF MEXICO GASTROPODS (TEREBRA AND OCENEBRA) *

By R. TUCKER ABBOTT

Associate Curator, Division of Mollusks, U. S. National Museum

The Gulf of Mexico is still relatively unexplored for mollusks, and despite the occasional acquisition of new forms from shrimp fishermen, the subfaunal regions and subspeciation problems are as yet poorly understood. As more specimens from new localities appear, the morphological boundaries between some species become less pronounced, especially in such families as the Muricidae (*M. beaui* versus *branchi*), Conidae (*C. clarki* versus *C. frisbeyae*) and the Volutidae.

During the past several years, we have had an attractive and unknown *Terebra* sent for identification by several private collectors. The unusually fine series submitted by Barbara and Dan Steger of Tampa, Florida, has prompted us to describe what we believe is a new subspecies of *Terebra floridana* Dall. The shells are quite variable in color, sculpture and proportions, but despite the obvious differences seen in the most divergent specimens, there is sufficient overlap of characters to consider it only as a subspecies. Typical *T. floridana* is known from 5 to 118 fathoms of water along the east coast from South Carolina to Key West, Florida; the subspecies described here is known from the region north of Campeche Banks, Yucatan Peninsula, Mexico.

Dall originally described *floridana* in very meager terms.

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Therefore, we are giving a fuller description and some additional records.

TEREBRA (MYURELLA) FLORIDANA Dall. Pl. 2, fig. 7

Terebra (Subula) floridana Dall 1889, Bull. Mus. Comp. Zool., vol. 18, pt. 2 ("Blake Report"), p. 63; 1902, Proc. U. S. Nat. Mus., vol. 24, no. 1264, p. 503, pl. 29, fig. 9; 1903, reprint of Bull. 37, U. S. Nat. Mus., pl. 75, fig. 9.

Description.—Shell from 50 to 75 mm. (2 to 3 inches) in length, very slender, its width being about 1/7 of its length; with 24 to 30 whorls; angle of spire about 10°; color a semi-glossy, uniform, pale lemon-yellow to yellowish white; 2 nuclear whorls smooth, opaque-white, the last being slightly larger than the first postnuclear whorl. Sculpture between sutures consists of two spiral rows of short, retractively slanting axial riblets which occupy the upper two-thirds of the whorl. The ribs in the upper row (immediately below the suture) are twice as long as those in the lower row. The lower one-third area of the whorl is concave, usually smoothish, but may have very weak, protractively slanting riblets or growth lines or bear three to six weak, spiral threads or incised lines. Outer lip with a fairly strong sinuation at the periphery of the whorl. Siphonal canal fairly short and slightly twisted to the left. Columella with two very weak folds, the upper one being almost obsolete. Operculum horny, transluscent-brown, quadrate ungulate.

This species is characterized by its long, slender, yellowish shell and relatively straight siphonal canal. It belongs to the subgenus *Myurella* Hinds 1845.

Records.—SOUTH CAROLINA: 63 miles S.E. of Charleston, 45 fms., *Pelican* station 195–7. FLORIDA: just off Grecian shoals, east side of Key Largo, 56 fms., coral sand bottom, April 9, 1886, *Albatross* station 2640 (holotype, U.S.N.M. 87222); about 6 mi. due south of Key West, 45 fms., coral bottom, bottom temp. 75° F, Jan. 15, 1885, *Albatross* station 2318 (paratype, U.S.N.M. 93678); 2½ mi. off Fowey Rocks, 36 fms., sand, bottom temp. 74° F, Mar. 30, 1903, *Fish Hawk* station 7517; off Sambo Reef, 118 fms., 1916, *Eolis* station 331; off Miami, 5 fms., 20 fms., 25 fms., 30 fms., 40 fms., all *Eolis* stations.

TEREBRA (MYURELLA) FLORIDANA STEGERI n. subsp.
Pl. 2, figs. 5–6

Description.—Shell 50 to 80 mm. (2 to 3 inches) in length, moderately slender, its width being about ⅓ of its length. Similar to *floridana,* but differing in being stouter, in ranging in color from bright-orange, lemon-yellow to waxy white, in having the siphonal canal considerably more twisted to the left, in having weaker and more numerous axial riblets which increase in number in later whorls, and in lacking the upper fold on the columella in nearly every specimen. Operculum like that of *floridana.*

Length	Width	No. Whorls	
68.0 mm.	13.0 mm.	23	Holotype, U.S.N.M. No. 613884
69.0 mm.	11.5 mm.	25	Paratype, U.S.N.M. No. 613885
66.0 mm.	15.0 mm.	+18	Paratype, U.S.N.M. No. 605184

Types.—The holotype (613884) and seven paratypes (613885) are in the U.S.N.M. Two specimens from the Campeche Banks were kindly donated by Mr. and Mrs. Jack N. Sennott. Eleven paratypes were returned to Barbara and Dan Steger, after whom this subspecies is named, and one is in the Acad. Nat. Sci. Phila. No. 191709.

Type locality.—50 miles west of Campeche, Yucatan Peninsula, Mexico, in 12 fathoms. Collected in 1953 by the Stegers' shrimp boat, the "Sea Hag."

Remarks.—There is a superficial resemblance between *stegeri* and *T. taurina* Solander (formerly *flammea* Lamarck), particularly in the early whorls. However, the much larger *taurina* differs in having a longer and straighter siphonal canal, in being spotted with color, and in having nearly twice as many, much finer, axial riblets that extend from suture to suture. The degree of slant of the riblets is about 40° off the axis of the shell in *taurina,* and about 10° in *stegeri.*

The axial riblets are coarser, larger and fewer in number in *stegeri* than those in *floridana.* In the last whorl, *stegeri* has from 28 to 39, while the latter has from 17 to 23 (rarely up to 26). The angle of spire is more variable in *stegeri,* ranging from 14° to 10° with a mean of 13°, while in *floridana* the range is from 11° to 8° with a mean of 10°. Although these differences

are mathematically small, the resulting obesity of these long shells is quite different to the eye.

We have a single specimen 55 mm. in length which has all the characters of *floridana,* except that it has numerous, brownish color flammules and weaker subsutural riblets. It was dredged in 36 fathoms by the Fish and Wildlife boat, "Pelican," 44 miles southwest of Pensacola, Escambia County, Florida (U.S. N.M. 485734). Until other specimens are collected, we refrain from naming what may be either a color form or possibly a hybrid between *floridana* and *taurina* Solander.

Terebra (Strioterebrum) arcas n. sp. Pl. 2, fig. 4

Description.—Shell 15 to 27 mm. (1 inch) in length, moderately slender, its width being about ¼ of its length; semiglossy, usually opaque-white, but may be blushed, particularly on the early whorls, with light yellowish orange; rarely with one wide spiral band of orange; 1½ nuclear whorls smooth, glossy, transparent and clear or tan-orange. Suture sharply impressed and wavy. Whorls convex. Axial ribs strong, smooth, moderately arched and extending uninterrupted from suture to suture; 12 to 16 ribs per whorl, with the interstices concave and with rounded sides. Spiral sculpture consists of 5 to 7 sharply incised lines which are absent or weak in the first few whorls, but become increasing strong in later whorls. Only the uppermost and strongest incised line crosses the crest of the axial ribs in some specimens. Last whorl and base well-rounded and with a total of about 16 incised spiral lines. Lower half of outer lip slightly advancing. Siphonal canal relatively large and only slightly twisted. Siphonal fasciole bordered above by a small, sharp thread. Columella with one weak, spiral fold at the base.

Length	Width	No. whorls	
27.0 mm.	7.0 mm.	15	Holotype, U.S.N.M. No. 613882
24.5 mm.	4.5 mm.	12	Paratype, Steger Collection
7.0 mm.	2.3 mm.	8	Paratype, U.S.N.M. No. 613883

Types.—Twenty-one paratypes were returned to the Steger collection in Tampa, Florida; one is in the Acad. Nat. Sci. Phila., No. 191712, and 8 are in the U. S. National Museum, No. 613883, including the holotype, U.S.N.M. No. 613882.

Type locality.—East of Arcas Cays, southern Campeche Bank, Mexico, 23 to 24 fathoms. 1953. Shrimpboat, "Sea Hag."

The type lot is apparently a mixture of the above locality and two others: 35 miles E.N.E. of Arcas Cays, 17 fathoms; and 25 miles N.N.W. of Arcas Cays, sandy mud, 26 fathoms. I suspect that the 14 young specimens, which show little spiral sculpturing, come from one locality, and that the two orange-banded specimens are from another locality.

Remarks.—In morphological characters, *Terebra arcas* is closest to *T. glossema* Schwengel 1940 and 1942 (see NAUTILUS, vol. 53, pl. 12 and vol. 56, p. 65, pl. 6). The latter was recorded from off Pelican Shoal, Florida Keys, and the National Museum now has specimens from 1 to 3 fathoms from Cardenas Bay, Cuba, collected by the Tomas Barrera Expedition. *T. glossema* differs in having more and less arching axial ribs (27 on the last whorl) and in having much flatter-sided whorls. Both of these species (or subspecies) somewhat resemble *T. nassula* Dall from the West Indies and the shallow-water *T. protexta* Conrad of southeast United States.

OCENEBRA (OCINEBRINA) EMIPOWLUSI n. sp. Pl. 2, fig. 3

Shell.—Small, from 7 to 8 mm. in length, broadly fusiform, and somewhat resembling a *Favartia;* color white throughout; 3½ post-nuclear whorls; last whorl with 6 rounded axial, varix-like ribs; penultimate whorl with 7 to 8 similar ribs; the spiral sculpture consists of strongly raised, squarish, slightly fimbriated cords of which there are 17 to 20 on the last whorl, and 4 to 7 showing on the apical whorls. The one nuclear whorl is pronounced, glossy-white and bearing on the first half turn a strong, smooth spiral, carina, which gives the nucleus an obliquely carinate appearance; last half or third of nucleus without the carina, and succeeded abruptly by the well-sculptured post-nuclear whorls. Aperture oval, almost complete and somewhat spout-like, with a thin, sharp inner and outer lip. No anal fasciole present. Inside of outer lip with 5 or 6 weak, elongate, glossy-white teeth of spiral origin. Outer lip slightly crenulate. Siphonal canal well developed, and almost closed along its length, except for a narrow slit. To its left are the ends of 3 or 4

earlier siphonal canals which overlap each other, one inserted in the other. Operculum horny, light-brown, oval, narrowed at the siphonal end, and ungulate in structure.

Length	Width	No. whorls	
8.0 mm.	5.0 mm.	4.5	Holotype, U.S.N.M. No. 613881
7.5 mm.	4.5 mm.	4.5	Paratype, A.N.S.P. No. 191711
7.9 mm.	4.5 mm.	4.5	Paratype, D. Steger collection

Types.—Holotype in U.S.N.M. No. 613881; on paratype in A.N.S.P. No. 191711; three paratypes returned to the Steger collection in Tampa, Florida.

Type locality.—90 miles west of Fort Myers, Florida, in 90 fathoms; rubble bottom. Dredged from aboard the shrimp trawler, "Sea Hag" in 1953 by Captain M. E. Powlus, after whom the species is named.

Remarks.—This is the third *Ocenebra* to be described from the Western Atlantic. The first was described by C. B. Adams as *Fusus muricoides*, the synonymy of which is appended below. *Ocenebra muricoides* differs in having 9 to 10 smaller, axial ribs, in being more elongate, with a mauve-brown aperture, and in having strongly-colored, spiral bands of cream and reddish brown.

O. emipowlusi apparently belong to the subgenus *Ocinebrina* Jousseaume 1880, Revue et Magasin de Zool. for 1879, p. 332 (original type designated: *Fusus corallinus* Scacchi [= *O. aciculata*]). *Corallinia* Bucquoy, Dautzenberg and Dollfus 1882, Moll. Marins du Roussillon, vol. 1, p. 24 and vol. 2, p. 765, is a synonym, with *aciculata* Lamarck as the original genotype designated. *Dentocenebra* Monterosato 1917, Boll. Soc. Zool. Italiana, ser. 3, vol. 4, p. 21 is a subjective synonym with *Purpura edwardsi* Payraudeau 1826 as the genotype. The latter species is closest, especially in nuclear characters, to our *O. emipowlusi*. Such Eastern Pacific species as *gracillima* Stearns, *interfossa* Carpenter, and *lurida* Middendorff apparently belong to this subgenus.

Additional anatomical studies are needed to clarify the position of the subgenus *Favartia* Jousseaume. Clench and Farfante treat it as a subgenus of *Murex* (Johnsonia, vol. 1, no. 17, p. 51), but it could probably be treated as a subgenus of *Ocenebra*.

OCENEBRA (OCINEBRINA) MINIROSEA n. sp. Pl. 2, fig. 1

Murex (Chicoreus?) micromeris Dall 1890, Trans. Wagner Free Inst. Sci., Phila., vol. 3, pt. 1, p. 141 (in part).

Shell.—Small, from 5 to 7 mm. in length, elongate-fusiform; color all pink or yellowish tan with a pink or brownish pink aperture; 4½ postnuclear whorls; last whorl with 7 to 9 rounded, axial ribs, the last of which forms a thickened varix; penultimate whorl with 9 to 11 similar ribs; spiral sculpturing consists of strongly raised, squarish cords which are crossed by distinct, crowded fimbriations. The latter are inclined to be fluted and raised into minute spine-like projections in the region of the axial ribs. The lowest cord, just above the ends of the former siphonal canals, bears 5 to 7 large, fluted scales. Last whorl with about 10 of these major spiral cords, but one or two much smaller fimbriated threads may occur between them. Nucleus with one smooth, glossy, pink or whitish whorl. Aperture oval; peristome almost complete and somewhat spout-like, with a thin, sharp inner and outer lip. Inside of outer lip with 5 or 6 weak, elongate teeth. Outer lip crenulate. Siphonal canal well developed, and almost closed along its length, except for a narrow slit. The ends of 3 or 4 siphonal canals show at the left.

Length	Width	No. whorls	
7.5 mm.	4.0 mm.	5.5	Holotype, U.S.N.M. No. 103380
5.6 mm.	3.0 mm.	5.0	Paratype, U.S.N.M. No. 416655
5.0 mm.	2.8 mm.	4.5	Paratype, U.S.N.M. No. 416655

Type locality.—Jamaica, West Indies. Dredged by the "Albatross," but no station record; probably off Kingston.

Types and records.—Holotype, U.S.N.M. No. 103380 from Jamaica; paratypes in U.S.N.M. from Boqueron Bay, Puerto Rico (161271); St. Thomas (103413); 1 mi. southeast of Fowey Light, Florida, in 25 fathoms by the "Eolis" Station 8 (416653); off Bear's Cut, Miami, in 18 to 20 fathoms, "Eolis" Station 113 (416655); off Government Cut, Miami, in 35 to 38 fathoms, "Eolis" Station 117 (416654).

Remarks.—*Ocenebra minirosea* is similar to Dall's *O. micromeris* described from the Caloosahatchie Pliocene beds of Florida, but differs from that species in being more elongate,

with more strongly fimbriated sculpturing, and in having one or two additional, more pronounced axial ribs per whorl. One might suspect that *micromeris* was a progenitor of the Recent *minirosea*.

OCENEBRA (OCINEBRINA) MURICOIDES (C. B. Adams)
Pl. 2, fig. 2

Fusus muricoides C. B. Adams 1845, Proc. Boston Soc. Nat. Hist., vol. 2, p. 3 (Jamaica).

Ricinula muricoides C. B. Adams, Clench and Turner, 1950, Occ. Papers on Mollusks (Cambridge, Mass.), vol. 1, no. 15, pl. 39, fig. 9.

Tritonalia (*Ocinebrina*) *caribbaea* Bartsch and Rehder, Smithsonian Misc. Coll., vol. 98, no. 10, p. 7, pl. 1, fig. 1 (Old Providence Island).

We are adding the above synonymy of the third Western Atlantic species of *Ocenebra,* and a figure of the holotype of *Tritonalia caribbaea* Bartsch and Rehder which appears to be a synonym of *O. muricoides* C. B. Adams.

SOME NOTES ON THE RADULA

BY S. C. HOLLISTER

During the course of a recent field trip to Sanibel Island, Florida, when the writer attempted to relate juvenile to adult stages among some of the *Fasciolaria* by means of radula characters, it was discovered that the number of cusps on the laterals of *F. gigantea* vary with the length—hence with the age—of the shell. Collecting was at once begun of other species, and subsequently specimens of several series have been examined. The accompanying chart (Fig. 1) gives the relation between the length of the shell and the number of cusps on the lateral plates for *F. gigantea* Kiener and *F. tulipa* Linné.

Two species of *Busycon* were also examined, *B. "contrarium"* B. Smith (= *B. perversum* of authors) and *B. carica* Gmelin. The laterals of this genus have two large cusps with smaller

intermediate cusps between them. Only these intermediate cusps are here plotted. The chart shows that the number of these intermediates varies similarly with the length of shell for both species.

The number of cusps on the laterals on each side of a given radula were not always alike. The central teeth of the species of *Busycon "contrarium"* did not possess a constant number of cusps; they varied from three to seven. This variation was not dependent on sex or size of shell. Several specimens from Harkers Island, N. C., had six or seven, while several from Sanibel, Florida, and the Dry Tortugas had five or less. More data are required before these geographic differences may be considered significant.

B. carica from Harkers Island had six cusps on the central tooth, while specimens from Cape Cod had only four or five. Such variation did not depend upon sex or size of shell.

Sterki, in Proc. ANSP, vol. 45, 1893, p. 388, pointed out the need for ontogenetic and morphologic studies of the glosso-

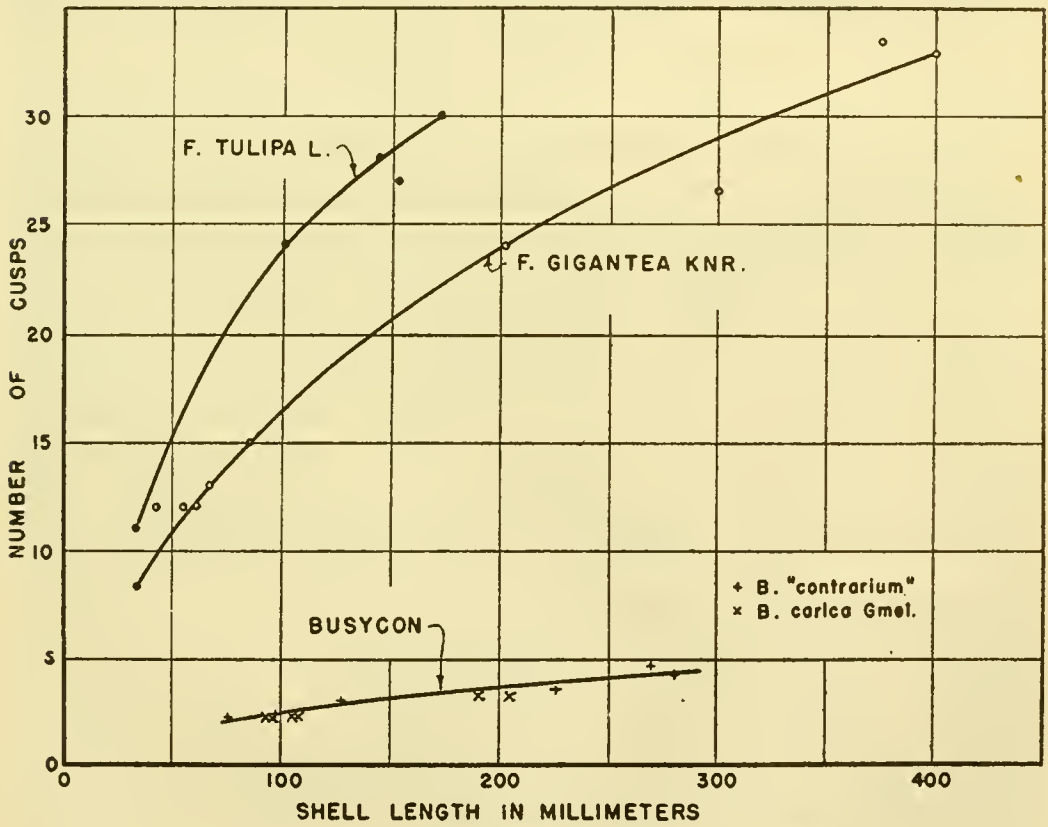

Fig. 1.

phorous molluska generally. In his own studies of land snails he had noticed that "certain characters of the radula which are very indistinct in the adult, or even overlooked by careful observers, become of characteristic value in the light gained by the examination of the earliest stages of growth." As an example, it was found that in the young of *F. gigantea* there were on the rachidian tooth three nearly equal cusps, while in the gerontic stage the central cusp remained with scarcely vestiges of a suggestion that the cusps on either side had existed earlier.

When reporting upon dentition of radulae it would appear desirable to include in addition to the detailed description of the radula, (1) size of shell and number of whorls; (2) sex; (3) locality. In this way a body of literature for comparative study may be accumulated. The shell should be retained for later study. Characters of radulae other than number of cusps should be noted for diagnostic purposes.

SOME MARINE SHELLS FROM THE PERSIAN GULF

By Dr. F. HAAS (Chicago)

Chicago Natural History Museum has received recently a small collection of marine shells which were collected by Mr. Ronald Codrai, from January to July 1953, at Dubai, on the Trucial coast of Oman. Dubai, also written Dibai or Dabai on various maps, is situated south of Sharja, at about 25° 10′ North Latitude and 53° 20′ East Longitude. Dr. Henry Field of Coconut Grove, Fla., presented us with the collection mentioned above which is his second contribution to our knowledge of the molluskan fauna of the Persian Gulf (see Haas, 1952). The species contained in this second collection are listed here:

Diodora funiculata (Reeve)
Haliotis (*Sanhaliotis*) *planata* Sowerby
Trochus (*Infundibulops*) *cariniferus* Beck
Trochus (*Infundibulops*) *erythraeus* Beck
Thalotia (*Thalotia*) *kotschyi* (Philippi)
Umbonium (*Umbonium*) *vestiarium* (Linnaeus)
Turbo (*Marmorostoma*) *radiatus* Gmelin
Nerita (*Theliostyla*) *plexa* Chemnitz

Turritella (*Haustator*) *maculata* Reeve
Cerithidea (*Cerithideopsis*) *fluviatilis* (Potiez & Michaud)
Clava fasciata (Bruguière)
Clypeomorus clypeomorus Jousseaume
Calyptraea (*Crucibulum*) *violacea* (Carpenter)
Canarium (*Conomurex*) *luhuanum mauritianum* (Lamarck)
Polinices (*Neverita*) *ampla* (Gmelin)
Polinices (*Polinices*) *mamilla* (Linnaeus)
Erosaria (*Erosaria*) *turdus turdus* (Linnaeus)
Niotha albescens splendidula (Dunker)
Niotha clathratula (A. Adams)
Fusus (*Fusus*) *colus colus* (Linnaeus)
Oliva (*Carmione*) *inflata* Lamarck
Oliva (*Oliva*) *ispidula* (Linnaeus)
Ancilla (*Ancilla*) *cinnamomea* Lamarck
Cylinder pennaceus (Born)
Bulla (*Bulla*) *ampulla* (Linnaeus)
Arca (*Arca*) *uropygmelana* Bory de St. Vincent
Arca (*Barbatia*) *fusca* Bruguière
Arca (*Acar*) *plicata* Chemnitz
Glycymeris (*Glycymeris*) *taylori* (Anags)
Glycymeris (*Pectunculus*) *nodosus* (Reeve)
Glycymeris (*Pectunculus*) *pectiniformis* (Lamarck)
Pteria (*Pinctada*) *inflata* (Schumacher)
Pecten (*Chlamys*) *senatorius* Gmelin
Spondylus foliaceus Chemnitz
Ostrea (*Lopha*) *crista-galli* Linnaeus
Cardita (*Cardita*) *bicolor* Lamarck
Codakia (*Jagonia*) *fibula* (Reeve)
Laevicardium (*Trachycardium*) *flavum* (Linnaeus)
Erronea (*Erronea*) *caurica caurica* (Linnaeus)
Mauritia (*Arabica*) *arabica arabica* (Linnaeus)
Notocypraea pulicaria (Reeve)
Semicassis (*Semicassis*) *pila* (Reeve)
Cymatium ranzanii (Bianconi)
Pyrula papyratia reticulata Lamarck
Murex (*Murex*) *ternispina* Lamarck
Chicoreus (*Chicoreus*) *anguliferus* Lamarck
Drupa (*Morula*) *concatenata* (Lamarck)
Mancinella (*Mancinella*) *intermedia* (Kiener)
Mitrella (*Mitrella*) *blanda* (Sowerby)
Lampusia pilearis (Linnaeus)
Rapana bulbosa (Solander)
Bullia (*Bullia*) *mauritiana* Gray
Nassa (*Nassa*) *pullus* (Linnaeus)
Lioconcha callipyga (Born)
Gafrarium (*Circe*) *lenticulare* (Deshayes)

Gafrarium (*Circe*) *scriptum* (Linnaeus)
Sunetta (*Sunetta*) *scripta* (Linnaeus)
Dosinia (*Dosinidia*) *contracta* Philippi
Dosinia (*Dosinidia*) *laminata* (Reeve)
Venus (*Chione*) *lilacina* Lamarck
Mactra (*Mactra*) *grandis* Gmelin
Mactra (*Mactra*) *lilacea jickelii* Weinkauff
Asaphis (*Asaphis*) *deflorata* (Linnaeus)
Angulus (*Homala*) *triradiatus* (H. Adams)

Thalotia (*Thalotia*) *kotschyi* (Philippi) is the only species endemic in the Persian Gulf that is represented in the collection.

Haliotis (*Sanhaliotis*) *planata* Sowerby. The only specimen of what I think is this species differs in various respects from the original description as well as from the specimen of *planata* at hand, which comes from the Philippine Islands (Chicago Natural History Museum no. 32896). It is much larger, 110 mm. against about 45 mm. for typical *planata;* furthermore, it is by no means flat, its height being 27.5 mm. However, the pattern of the surface sculpture and the coloration of the upper side are in conformity with the indications given by Sowerby in his original diagnosis of *planata.* What induces me to believe that the shell from Dubai is identical with Sowerby's species is that its umbonal region, in fact the entire shell with the exception of the last half whorl, is very much flattened and that it therefore looks very much like a specimen of *planata,* measuring 45 mm. in length. It is, thus, conceivable that our Dubai specimen is really an adult *Haliotis planata,* such as, apparently, had never come to be known before. This is the second record from the Persian Gulf, the first having been published by Melvill (1928, p. 96).

Cymatium ranzanii (Bianconi). The specimen from Dubai resembles *C. tigrinum* (Broderip) from the Pacific coast of Central America in its triangular aperture. No similar species has ever been reported from the Indopacific Ocean; however, *C. ranzanii,* originally described from Moçambique, East Africa, looks very much like our specimen from the Persian Gulf, so that I, tentatively, identify the Dubai specimen as such. Bianconi's species seems to have been figured only once, by Tryon (1881, pl. 10, fig. 71) and to the best of my knowledge it has not been reported again.

Despite the many contributions toward our knowledge of the molluskan fauna of the Persian Gulf, mostly by Melvill alone or with associates, our knowledge of the littoral shells of that region is still very imperfect. The rather extensive literature on the mollusks of the region under consideration is to be found in Melvill's publication of 1928. It is strange that we should know comparatively more about the deepwater shells, obtainable only through dredging operations, than about the shore fauna, which can be collected without the use of instruments; nevertheless, this is the case.

Under these circumstances, even smaller collections, such as the one dealt with here, are of considerable importance, since they always help to increase our defective knowledge. This knowledge about the malacofauna of the Persian Gulf, as of today, does not yet allow the drawing of definite zoogeographical conclusions about the origin of the shell fauna of the region; all that can be said now is that the bulk of the Persian Gulf mollusks is of Indopacific origin, that a certain, not yet appreciable portion of this fauna is Erythrean, or from East Africa, and that but very, very few species are endemisms. The role which the many smaller deep-water shells described by Melvill and his associates play in this distribution, is not yet clear, since almost all of them are known only from the original finding and the original locality. This does not exclude, however, the possibility that in the future they may be found outside of the region we are concerned with.

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THE MEADOWS COLLECTION OF ACHATINELLIDAE

By YOSHIO KONDO

The Edmund J. Meadows Collection of Oahu (Hawaii) Achatinellidae was one of many that were examined between July and December 1953 while studying in four museums across the U. S. with the aid of a fellowship granted by the Guggenheim Foundation. Principal aspects of these researches will be submitted at a later date.

In recent years, several species and lesser forms of *Achatinella* have become so rare where they once flourished that today they may be considered nearly extinct. Private collections containing all or most of the 42 species are not abundant and any representative collection finding its way into institutions will be of value in the future.

In 1947 the Museum of Comparative Zoology acquired the Meadows Collection from John Q. Burch. It consists of 40 species of *Achatinella*, one *Partulina*, eight *Amastra*, and three *Laminella*. The *Achatinella* species are distributed among 653 lots totalling 9225 specimens. Two species not in the collection are *A. solitaria* Newcomb and *A. thaanumi* Pilsbry and Cooke. Only two specimens of the former are known (Cumingian Coll.) and this species may be dextral aberrants of the sinistral *A. fulgens* Newcomb.

History. Edmund Meadows began collecting in 1925 but he did not begin to accumulate a systematic series until 1932 at which time he joined William H. Meinecke in his field trips. This association continued until 1942, so that the Meadows series may be considered a modest duplication of the Meinecke Collection now in the Bishop Museum. Others with whom Meadows collected occasionally were Brickwood Lyman, Leopold Blackman, Irwin Spalding, and George Arnemann.

Mapping. Meadows attempted to map every locality in which he collected. Most of the stations are plotted fairly closely but many, particularly those in the deep interior and in mist-covered highlands, should be considered doubtful until closely checked with the Meinecke Collection and maps.

Data. No data except his rough maps exist. Shells were not numbered.

Labels. Small slips of paper with locality numbers were enclosed with most of the shells. Specific names were given for some but were omitted in many instances.

Exchanges. Shells acquired from colleagues were added to his collection without notation.

Storage and arrangement. Flat cardboard boxes containing 48 units, each 1½ inch square, were used to hold the species of a certain region. Box No. 1, for instance, contained the five species from Kealakei, Kuliouou, and a part of Niu Valleys. Colonies were numbered from 1 to 8. *A. phaezona* was from colony 1, *taeniolata* from 1, 2, 3, 6; *fuscobasis* from 8, *viridans* (*rutila*) from 4 and 7, and *fulgens* from 5 and 6. Box No. 2 contained the species from 1½ valleys to the east of No. 1, the colonies being numbered from 1 to 5. The circuit of the Kollau range was made clockwise and contained in 39 boxes. Maps were pasted inside the cover.

Shells were arranged from left to right, top to bottom; each lot was separated from the adjoining by one empty unit or more.

Several colonies were often lumped together. The label would then read 1.2.3.4., etc. Several lots contained no labels. Some labels had no accompanying shells. Quite often labels of two species were switched.

Evaluation. In spite of the errors enumerated, the Meadows Collection will be of value, due to the reasons given in paragraph two, above.

TWO NEW SUBSPECIES OF MONADENIA FIDELIS (GRAY)

By ROBERT R. TALMADGE

Willow Creek, California

In the course of an intensive study of the distribution of the large banded coastal snail *Monadenia fidelis* (Gray) in the Klamath Mountains of northern California and Oregon, two well-defined, new races have been found. Until recently little

has been done on the interesting distributional problems presented by the genus, since Dr. S. Stillman Berry of Redlands, California described several new species and sub-species. Although Allyn Smith and the Chaces had made collections from portions of the territory, there were many gaps that needed attention. This called for a systematic check of the territory, part of which had been worked, but much of which was still a blank. New areas were opened to science by the aid of students and other interested groups.

An important contribution to the distributional problem was made a short time ago by Mr. Rae Baxter, a fisheries student, at Humboldt State College, Arcata, California, while collecting a series of *Monadenia fidelis* along the Oregon coast. In his material was a new off-shore ecological form, easily distinguished from the adjacent mainland forms. Another new form was located by tracing the distribution of specimens on the basis of animal coloration from an area where apparent intergradation exists to a locality where the animals of the snails collected have a consistently uniform coloration. Specimens from this locality were brought in by an Explorer Scout expedition to the Marble Mountains, Siskiyou County, California.

Monadenia fidelis baxteriana Talmadge, new subspecies

A small, high-spired *Monadenia* of six and one-half well-rounded whorls, suture deep, aperture large and ear shaped, with a thin peristome that flares back at the base and half covers the small umbilicus. The nuclear sculpture is too eroded for adequate description. From the second whorl, the sculpture consists of a series of fine, rounded striae, which in many specimens are carried over onto the base. The close set lines of growth are cut by the striae, forming a checked aspect. The periostracum is highly polished on the base, but is somewhat duller on the spire. Color of the shell tawny on the dorsal surface, with a black-brown periphical band about two millimeters wide, base a rich chocolate brown. Measurements of five specimens are as follows.

No. 763. Diam. max. 27, min. 23, alt. 16, umb. 2 mm. Holotype

No. 730. Diam. max. 28, min. 24, alt. 16, umb. 2 mm. Paratype
No. 730. Diam. max. 28, min. 22, alt. 16, umb. 2 mm. Paratype
No. 730. Diam. max. 27, min. 24, alt. 17, umb. 1¼ mm. Paratype
No. 730. Diam. max. 29, min. 25, alt. 17, umb. 2 mm. Paratype

Animal: Maculations are a dull purple interspaced with areas of dull black. There is no trace of a dorsal stripe nor does the flare of the foot or tail become lighter in hue. The foot is a dull gray with purplish tints at the edge. The animal is remarkably uniform in coloration and except for the rare *M. marmarotis* is the darkest known of the *Monadenia.*

Type locality: Sisters Rocks, a few hundred feet off-shore in Curry County, Oregon. Taken from under drift logs and rubble on grass-covered rocks by Mr. Rae Baxter in July 1953.

Type: in Talmadge Collection, Willow Creek, California. Paratypes in the collection of the California Academy of Science, and the private collections of Allyn G. Smith and Rae Baxter.

Remarks: This form occupies the same ecologic position on the Oregon coast that *M. f. pronotis* Berry and *M. f. trinidadensis* Talmadge do on the northern California coast. *M. f. baxteriana* seems to be more closely related to the adjacent mainland forms than to the other off-shore races. Compared with the more or less typical *fidelis* and the green based *beryllica, baxteriana* can be easily separated by size and color of the animal. *Baxteriana* will probably be found on other suitable grass-covered rocks on the same general reef. It is assumed that when the headlands became separated from the coast, a few snails survived and due to unfavorable ecologic factors became dwarfed. These large broken off headlands are generally further broken up into scattered rocks. *Baxteriana* like the two California off-shore races will probably be found on these other rocks as they are explored. This subspecies is named after Mr. Rae Baxter, of Humboldt State College, who gathered the first material.

Monadenia fidelis salmonensis Talmadge, new subspecies

Shell a medium-sized *Monadenia* of six and one-half whorls, with a somewhat depressed spire, and a well-defined deep suture. There is no trace of a carina on juveniles except those under 25 mm. in diameter, the aperture is ear shaped and large, depressed above, peristome thin, recurving at the base so as to cover one-third to one-half of the well-like umbilicus, the latter being contained in the diameter of the shell about ten times. Sculpture consists of a series of sharp ridges that cut across the whorls diagonally, parallel to the lines of growth, and are carried onto the base where they smooth out as the umbilicus is reached. There is no noted spiral sculpture. The periostracum is dull but shows a sheen on fresh specimens under side lighting. Color of the shell is remarkably uniform, even at extremes of the color pattern. All specimens are multibanded with the spire ranging from ochre to burnt ochre. A dark brown band follows the suture to the periphery of the body-whorl, where it widens to about two and one-half millimeters. Above this each whorl has two distinct faint bands of burnt ochre to chestnut that are spaced equidistant between the suture and the periphery of each whorl. Below the periphical band there is a narrow ochre to straw-colored stripe that is about one to one and one-half millimeters wide. The base is the usual polished brown, but is cut with numerous flares of tawny yellow, radiating out from the umbilical pit. In some examples this yellow area covers nearly one-half the base.

The measurements of five specimens are as follows:

No. 764. Diam. max. 33, min. 28, alt. 18, umb. 2 mm. Holotype

No. 749. Diam. max. 33, min. 28, alt. 18, umb. 2 mm. Paratype

No. 749. Diam. max. 22, min. 29, alt. 18, umb. 2 mm. Paratype

No. 749. Diam. max. 35, min. 30, alt. 21, umb. 2¼ mm. Paratype.

No. 749. Diam. max. 33, min. 28, alt. 19, umb. 2 mm. Paratype

Animal shorter and thicker than animals of the same size in adjacent and allied races, maculations small and oval, color tan interspaced with areas of dull black. The distinct dorsal stripe consists of a double set of rod-shaped maculations of a lighter hue, almost an ivory. The flare of the foot and tail appears darker than the rest of the animal, but this is found to be caused by the much smaller maculations in these areas. The foot is tan.

Type locality: Wooley Creek, from near mouth (elevation ca. 1200) to the vicinity of the North Fork of Wooley Creek (elevation ca. 3000). Salmon River, Siskiyou County, California. Taken under logs by the Explorer Scout Expedition to the Marble Mountains August 1953.

Additional localities: Steinacher Creek, a tributary to Wooley Creek, elevations ca. 1200 to 2500 feet, by Mr. Rae Baxter, Arcata, California.

Type: in the Talmadge Collection at Willow Creek, California. Paratypes deposited in the collection of the California Academy of Sciences and the private collections of Allyn G. Smith and Rae Baxter.

Remarks: During the summer of 1953 several field trips were made into the Salmon River region in an effort to trace the range of various subspecies of *Monadenia fidelis* that are found within this mountainous area. It had been found that *M. f. klamathica* Berry extended up the Salmon River a few miles. Between this station and a station where the *M. f. ochromphalus* Berry had crossed from the Scott River Valley into the Salmon drainage was an area that had not been systematically checked. Within this area snails that appeared to be intergrades were noted. This snail had a duller periostracum than either of the two known highly polished races. The animal was different and did not fit what might be considered an intergrade between *klamathica* and *ochromphalus*. The material brought back by the Explorer Scout Expedition and later by Rae Baxter yielded the first specimens of this new race. *Salmonensis* occurs in the glacial basins and creeks on the north side of the Salmon River in Siskiyou Co. It is a dull race that has apparently intergraded with both the *ochromphalus* and *klamathica* along much of the Salmon River and at the mouths of the side streams. These intergrades follow the coloration of more well-known

races, but have the duller periostracum of the *salmonensis*. The animals are closer to those of the river races, but always have a brownish cast, depending upon their location along the streams. Dr. Berry gave the range of *callindina* to include Butler Creek on the Salmon River. However, the writer has specimens from that area that are now known to be probable intergrades between *salmonensis* and *klamathica*. At first glance, comparing the shells and not the animals one would hardly hesitate to identify the specimens from this region as *callindina*. The animal of *salmonensis* is much browner than any other race of *fidelis* that the writer has noted. It is darker than *leonina* and the shell is much different. Compared with the more highly sculptured species, *cristulata* and *callipeplus*, the shell lacks the adornment and the coloration of the other animals. The snail is named after the principal waterway within its known range, the Salmon River.

THE INFLUENCE OF BOTTOM SEDIMENTS ON THE DISTRIBUTION OF FIVE SPECIES OF BIVALVES IN THE LITTLE ANNEMESSEX RIVER, CHESAPEAKE BAY

By J. FRANCES ALLEN

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Introduction

During the past several years, collections have been made of the pelecypoda which occur intertidally and subtidally along the shore of the Little Annemessex River in the vicinity of Crisfield, Maryland. The present paper is confined to a discussion of the occurrence and distribution of five bivalves, with reference to the influence exerted by sediment types.

The Little Annemessex River which is located on the eastern shore of Maryland, extends in an easterly direction from the lower end of Tangier Sound, for a distance of approximately two nautical miles as measured from the buoy at the outer side of James Island. After passing the inner end of James Island,

the Little Annemessex changes to a northern direction and runs between the mainland and James Island for a distance of approximately two nautical miles where it enters the Annemessex Canal, which in turn, empties on the other end into the Big Annemessex River. Three quarters of a mile below the entrance to the Canal, the small boat harbor comes off from the Little Annemessex River toward the east. (See U. S. Coast and Geodetic Survey Chart No. 1224.)

The shore line consists of beaches, separated intermittently by marsh and banks. The beaches vary in consistency; some are sand; some mud; and some a mixture of sand and mud, with a considerable variation in the proportion of the constituents. Clay is also an important part of certain mud-sand flats, especially where dredging for the small boat harbor canal was carried out.

Spartina alterniflora, the cord grass, and *Volsella demissa* Dillwyn), the ribbed mussel, together form the banks. The soil composition of the banks is mud, sand, and some clay. The mussel is present in great abundance throughout the entire area where it is found growing at the base of *Spartina alterniflora* and where it is embedded in the bank itself, as well.

The subtidal substratum also varies from sand to mud. The area which is sand beach becomes mud bottom as one goes off shore and then beyond that are areas which are sand. Generally speaking, however, the substratum off shore is mud, and according to Cowles (1930), the bottom of the Bay is mud except in a few rocky areas.

While the entire area was subject to random sampling, four stations were established. Station A was located on the inner end of a cove which indents easterly from the Little Annemessex at the southern limits of Crisfield; Station B, on the sand flat opposite the railroad sidings, midway up the Little Annemessex River; Station C, on another flat just below the entrance to the Annemessex Canal; and Station D, adjacent to the small boat harbor.

The area in general is quite shallow, the average depth ranging between one and four feet at mean low water. The channel is dredged to a depth of eleven and one-half feet for a width of 100 to 125 feet.

Materials and Methods

The bivalves under particular consideration here include: *Mya arenaria* (Linn.), *Tagelus plebeius* (Solander), *Macoma balthica* (Linn.), *Barnea costata* (Linn.), and *Mercenaria mercenaria* (Linn.)

At the four stations mentioned, transects were measured off from the shore beginning at the high tide mark, toward the deeper water. The average distance covered was 35 meters. At intervals of two meters, a one-half meter quadrat was established on each transect. The bottom material from each of these quadrats was collected and washed through a large flour sieve, having a mesh of 225 openings per square inch. In some cases where *Tagelus* was burrowing down into the substratum, the quadrat was dug to a depth of as much as two and one-half feet. Usually, however, the upper eighteen inches of soil was removed from each quadrat. In the case of *Mercenaria,* raking the quadrat with a clam rake usually sufficed for obtaining the specimens.

In addition to quadrat samples, large size areas were marked off at each station as well as in other localities, and all the bivalves exposed by systematic digging of the area, were collected. After the shells had been cleaned, length measurements were made to the nearest millimeter. The shell weights were determined on an analytical balance.

Observations

As has been previously mentioned, the composition of the bottom varies in different areas as far as its relative composition is concerned, the constituents being sand, mud, and clay. At Station A, on the cove flat, the bottom is soft, sticky black mud containing very little sand. Apparently there is a considerable amount of decomposition of organic matter, and there is, at times, a strong sulfide odor. Station B has a substratum which is a mixture of sand and mud, but it is predominantly sand, and becomes increasingly muddy as one goes off shore. Station C is also made up of sand and mud but the greater part is sand, which seems to be somewhat coarser than at Station B, and there is also a considerable amount of clay below the soil

surface. This flat is exposed to comparatively rough wave action. Station D, adjacent to the small boat harbor, is a bar shaped flat, about 150 feet in length when exposed at low tide. It is bounded by the channel which was dredged about seven years ago. The remainder of the flat is surrounded by an expanse of *Spartina patens*. The composition of the substratum consists largely of sand which becomes progressively more muddy as one approaches the inshore side. Beneath the mud and sand is hard clay. Near the channel and the bank, the flat is mud-sand.

Mya arenaria (Linn.), the soft clam, was found in all types of sediments examined. They vary in relative abundance depending upon the composition of the substratum. *M. arenaria* occurs intertidally as well as below the usual low tide level. In the areas of sand bottoms, they are more abundant than in the mud-sand habitat. Their siphons are long and they are able to live at a considerable depth.

It was noted that the shells of small clams are more abundant in the mud but apparently they do not survive the silting which occurs there. In the cove, Station A, where the bottom is black mud, this species occurs in large numbers during the first year of growth. This is shown by the fact that on April 3, 1952, 229 small clams were collected from an area less than 50 feet square. The specimens from this collection ranged in length from 5.8 to 29.3 mm., with an average length of 14.87 mm. The following July, only an occasional small clam was collected and the shore was littered with shells from dead clams.

At Station B, *Mya arenaria* was present but not as abundant as were the other bivalves. This species was totally absent from Station C. Its absence from the area where one would expect to find representatives may, in part, be due to the fact that there is a great deal of wave action here, and the surface sand is shifting. At Station D, adjacent to the small boat harbor, where there is considerable sand and clay, the same species ranged from 7.3 mm. to 52.1 mm. in length, with an average length of 25.18 mm.

Tagelus plebeius (Solander), the short razor clam, occurred in all locations but it was especially abundant where there was more mud than sand. Specimens collected ranged from 4.0 mm.

to 94.0 mm. in length. At Station A, the greatest number were between 65.0 and 75.0 mm. in length. At Station B, where there was more sand, the greatest number fell between 60.0 and 70.0 mm. in length. At Station C, where the surface is subject to wave action, this species was more abundant in mud and clay areas. The largest proportion of these bivalves from this station ranged from 70.0 to 74.0 mm. in length. Here, they burrowed to a depth of thirty inches. It was noted that the color of the foot and sometimes of the periostracum is much darker in the mud habitat, so that they tend to be dark green or black in color. At Station D, the greatest number were from 65.0 to 75.0 mm. in length. They were not as abundant here as they were at Station A or Station C.

Macoma balthica (Linn.) is found in mud and mud-sand flats where it grows to a length of 40.0 mm. In the cove, Station A, it ranks second only to *Tagelus plebeius* in number, with *Mya arenaria* being third in abundance. *M. balthica* was absent or occurred sporadically in mud-sand areas which were predominantly sand. At Station A, they ranged from 14.6 to 37.0 mm. in length, with the average length being 29.19 mm. Only two specimens were collected from Station C, 11.6 and 13.7 mm. in length, respectively. Again at Station D, only two *Macoma* were taken, one 23.7 mm. and the other 15.7 mm. in length. Their absence in these areas may be due to the shifting of the substratum as well as to the fact that the proportion of clay is relatively high.

Barnea costata (Linn.), the so-called angel wing, occurs in considerable numbers at Station D, the tidal flat where one section is mainly clay. Of the four areas examined, this was the only locality in which *Barnea* was found, and here it lives at a depth of as much as 26 inches. It ranged in size from 60.0 to 95.0 mm. in length, with an average length of 82.04 mm.

Mercenaria mercenaria (Linn.), the northern quahog, lives subtidally in the more sandy parts of the Little Annemessex River. This form does not occur intertidally in the Little Annemessex River. It is widely distributed off shore from the southeastern end of James Island which is the line of demarkation between the Little Annemessex River and Tangier Sound. It was found in small numbers off shore from Stations B and C.

Another aspect of distribution worthy of comment was shown by the transects extending off shore. These observations showed that *Tagelus plebeius* extends from the upper limits of the high tide line for a considerable distance off shore. *Macoma balthica* extends from between the tide marks in an off shore direction, and *Mya arenaria,* while somewhat intertidal in distribution, becomes more abundant as it moves off shore. In the Little Annemessex River, *Tagelus plebeius* is the most abundant of the bivalves, with *Macoma balthica* second in abundance in the muddy areas. However, *Mya arenaria* is second in abundance in the more sandy areas.

The influence of bottom sediments on growth and shell thickness may be noted from the data on *Tagelus.* Shell weights were determined on the razor clams from each of the four stations. The average weights of length groups which were most abundant in each area were determined first. It was found that at Station A, the cove, the average shell weight for the group between 65.0 and 75.0 mm. was 6.44 grams. The group from Station B between 60.0 and 70.0 mm. was 4.97 grams; from Station C, the group from 70.0 to 74.0 mm. was 7.47 grams; and from Station D, the group from 65.0 to 75.0 mm. was 8.17 grams. It was noted that those from Station D were considerably heavier in the same length range than were those from the muddy area of Station A.

The average shell weights were determined for those in the same size range, 60.0 to 70.0 mm., from each of the four stations. The results were Station A, 5.75 grams; Station B, 4.97 grams; Station C, 5.24 grams; and Station D, 6.23 grams. The shells which were lighter in weight were from the more sandy area, while those from the more muddy areas were intermediate in weight, and those from the more densely packed bottom of mud, sand and clay were the heaviest. It was noted that there was a greater uniformity of weights and size from Station A than from any of the other three localities.

Discussion

Newcombe (1935a) in his study of a sand beach in St. Croix River, New Brunswick, states that among the factors exerting a limiting effect on the rate of growth of *Mya arenaria* is the

soil; two types being unfavorable, soft mud with a layer of silt, and fine shifting sand. Below the mean low water level, the soil contained a high percentage of soft mud and for twelve meters below mean high water level, the soil consisted of coarse sand covered with small stones, and below this zone to the mean low-water level, a fine grade of sand was present. Below the mean-low water mark, *Mya* occurred only occasionally, and he found no submerged communities of clams.

As was noted at Station A, the cove, the soft sticky mud apparently affected the survival of the young clams, and at the other stations it was noted that *Mya* was more abundant in areas where at least part of the substratum contained a good deal of sand. Their absence from Station C, which was subject to considerable shifting, also bears out the fact that these forms are affected by shifting sand. The same author (1935b) found that in the Bay of Fundy Region, *Mya arenaria* maintains itself satisfactorily from below mean high tide toward the very low levels where there is a subsequent increase in mud, and at only very low levels are these conditions deleterious to animals. This indicates that with the decrease in the *Mya* population, there is an increase in the mud proportion of the substratum which may, at least in part, account for the absence or limited occurrence of this clam in the muddier areas.

Newcombe (1935a) gives the distribution of the soft clam in Puget Sound as extending from one and one-half meters above low tide to eight meters below low tide. This same author says that in the Gulf of St. Lawrence and in Chesapeake Bay, *Mya* communities are subtidal. In the area observed, the author agrees that *Mya* is subtidal but they are also intertidal as was demonstrated in all the areas examined where they occurred.

Swan (1952), after noticing differences in shell weight of soft clams from areas consisting of muddy sand to sand with fine gravel mixtures, and one where the sediment was a mud-sand-gravel mixture, planted experimental boxes containing both types of soil to see what effect the soil would have on the growth of the clam. He found after nearly a year's time that there was great individual variation in growth but that the average linear growth of the clams in sand was roughly double that of

those planted in a mud-sand-gravel mixture. Data are not available on *Mya* collected from the four stations relative to differences in shell weight of this form, but information is available regarding *Tagelus*. It was found that the shells were heavier at Station D, and that they were lighter at Stations, A, B, and C. The lightest in weight were collected from Station B, where the mud-sand mixture was predominantly sand. The heaviest ones occurred at Station D where there was considerable clay, and where they were not as abundant. Those with the lighter shell weight were taken from the more sandy areas. These findings agree with those of Swan (1952).

Dexter (1947) recognizes the *Mya-Nereis* biome at Cape Ann as that of the intertidal loose sediments. In the Little Annemessex River it was observed that *Mya* is present in the loose sediments and that they are not as abundant where the mud-sand-clay mixture is tightly packed.

Newcombe (1935a and 1935b) mentions the fact that the effect of large quantities of sulfide is practically non-existent and thus would not be a limiting factor. Similar observations at the cove, Station A, indicated the sulfide is high and it was also noticeable in the other areas examined, but apparently it has little or no effect.

Pearse, Humm, and Wharton (1942), when discussing burrowing mollusks, state that those slender clams with long siphons at Beaufort burrowed quickly and well and that the burrowing mollusks have either a wide slimy foot and a small shell and crawl with ease directly through the sand, or else they have a slender foot that can expand at the end and enough anchorage to pull itself downward. These same authors observed that *Tagelus gibbus* (*Tagelus plebeius*) frequents dark sands which border on muddy bottoms and that it can remain buried at a depth of from 40 to 50 cm., and also that it maintains two openings at the surface with the siphons. Observations by this author indicate that *Tagelus plebeius* prefers a similar habitat in the areas studied.

Fitch (1953) says that the northern razor clam, *Siliqua patula* (Dixon) occurs on broad sandy flats where they are exposed to pounding surf, and that they may dig to a considerable depth when disturbed. This trait may account for the survival of

T. plebeius to the exclusion of the other bivalves at Station C except for the two specimens of *M. balthica* collected from there. Like *T. plebeius, T. californianus* Conrad, has a smooth line permanent burrow. This latter form is found in muddy sand or mud in back bays, sloughs, and estuaries to a depth of 15 to 20 inches (Fitch, 1953). This characteristic also applies to *T. plebeius* for as previously mentioned it occurs at considerable depth, as much as 26 inches.

Barnea costata which was found only at one location, Station D, does occur elsewhere in the Bay. It has been collected by the author in the inshore region of Tangier Sound and in the inshore region of Pocomoke Sound.

Mercenaria mercenaria occurs only subtidally on the more sandy bottoms where it is found near the surface, slightly embedded in the bottom. This observation is similar to that of Pearse, Humm, and Wharton (1942) who state that at Beaufort, this species with its heavy short siphons does not burrow deeply.

Summary

Five bottom dwelling pelecypods have been collected in the vicinity of the Little Annemessex River. Quantitative samplings from four established stations have shown that their distribution and abundance is influenced by the composition of the substratum, and that shell weight of at least one form, *Tagelus plebeius*, is affected by the composition of the bottom sediments.

It has been pointed out that *Mya arenaria* occurs in all types of sediments but that it is most abundant in mud-sand bottoms where it occurs intertidally and subtidally. In muddy areas, it apparently does not survive one year of growth. Wave action and subsequent silting may prevent its occurrence in some areas. *Tagelus plebeius* prefers a mud-sand mixture where the greater part is mud. This form ranges from high tide line to well below low tide. *Macoma balthica* is found in all types of sediments but it is most abundant in mud-sand where there is a greater proportion of mud. *Barnea costata* occurs only in clay where it lives at a considerable depth.

Mercenaria mercenaria lives only subtidally in the sandy

bottoms where it is near the surface so that it is only slightly embedded in the bottom.

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A NEW SPECIES OF MESODON FROM THE GREAT SMOKY MOUNTAINS NATIONAL PARK

By LESLIE HUBRICHT

Mesodon (Inflectarius) verus new species

Shell imperforate, translucent, pale reddish-brown to cream-buff colored, depressed, spire convex or low conoid, whorls 5–5.5, periphery rounded, with a prominent crest and deep gutter behind the lip. First two whorls with radially elongated granules, third whorl with radial wrinkles and some spiral striae, spiral striae disappearing on the last two whorls, and radial wrinkles becoming more prominent with numerous erect triangular periostracal processes. Peristome white, rather widely reflected, thickened within, especially in the base, without teeth, outer lip somewhat dished, concave, descending in front. Parietal tooth well developed, long and slightly curved.

Diam. 13.5 mm., height 7.2 mm. Holotype.
Diam. 14.6 mm., height 7.8 mm. Largest paratype.
Diam. 12.1 mm., height 6.1 mm. Smallest paratype.

Type locality.—3570 ft., ravine, head of Mt. Sterling Creek, 1 mile north of Mt. Sterling Gap, Haywood Co., North Carolina. Holotype 607137 and paratypes 607138 U.S.N.M., paratypes 191211 A.N.S.P., and 12640 collection of the author.

Mesodon verus may be readily distinguished from all other members of the subgenus *Inflectarius* by the complete absence of teeth on the peristome. It bears a strong resemblance to *Mesodon subpalliatus* (Pilsbry) from which it may be distinguished by the difference in color, the prominent crest behind the lip, the strongly concave outer lip, and the longer and lower parietal tooth.

VARIATION IN THE OLIVE SHELLS OF TROPICAL WEST AMERICA

By HOWARD R. HILL

Curator of Marine Zoology, Los Angeles County Museum

In nearly every family of univalve mollusks, certain species show considerable variation in color, size and shape. In the olive shell family there are a number of variable forms found on the West Coast from Mexico to Chile. One species in particular, *Olive spicata* Röding, is so variable that twenty-eight different names have been applied to it and its nine varieties. No two authorities have agreed on the nomenclature for these forms. Consequently, students and collectors have long been confused as to the proper scientific names to use for them.

It is the hope of the writer that this paper will be helpful in the identification of the above-mentioned variable species. In addition, the variation in other olive shells of the tropical West Coast will be discussed.

1. Oliva spicata spicata Röding. Typical *O. spicata* is a common species, 2½ inches in length, ranging from West Mexico to Panama Bay. The typical form is found in the same regions as many of its color varieties. The shell is elongate with a moderate spire. The color of the aperture is white. Externally, the ground color is light gray or light yellow, shaded with a loose network of brown, pink-gray or blackish markings. The net-

work in some individuals is broken up into spots. The sutural fasciculations are elongate and dark in color. The synonyms are: *melchersi* Menke; *oriola* Duclos, *araneosa* Lam.; *oblonga* Marrat, *intertincta* Carpenter; *arachnoidea* Röding. The varieties are as follows:

a. *Oliva spicata violacea* Marrat resembles the typical form in all respects except that in this the aperture is violet in color.

b. *Oliva spicata pindarina* Duclos is like typical *spicata* in markings, but has spire more produced and is more angled at the periphery.

c. *Oliva spicata fuscata* Marrat has the color pattern nearly obliterated by reddish-brown. *O. perfecta* Johnson is a synonym.

d. *Oliva spicata cumingi* Reeve. In this variety, the network markings are not present. The shell is cream-colored with several wide, brown bands circling the body-whorl.

e. *Oliva spicata hemphilli* Johnson. In this nearly white form, only traces of the color pattern are present.

The following varieties are short and thick with short spires and short, dark fasciculations below the sutures:

f. *Oliva spicata venulata* Lamarck. This variety is the most common form of *spicata,* and is called the "Netted Olive" because of its network pattern of black zigzag lines over a ground color of either yellow or gray or olive. Lamarck described a decorticated or worn specimen of his *venulata* as a distinct species, *Oliva harpularia,* which is illustrated in Reeve's monograph on the olives. *Oliva punctata* Marrat is also a synonym of *venulata.*

g. *Oliva spicata polpasta* Duclos is quite similar to *venulata* but more slender and lighter in color. The network pattern is more or less broken up into dark spots. Occasionally two wide, cream-colored bands encircle the body-whorl.

h. *Oliva spicata subangulata* Philippi has a characteristic angular shoulder on the body-whorl. It might be mistaken for a small *Oliva angulata* Humphrey. However, the young of the latter, when they are the same size as the full-grown *subangulata,* do not have a well-developed shoulder angle. The network pattern of dark lines is speckled with black, triangular spots arranged in interrupted lines.

i. *Oliva spicata obesina* Duclos. This variety is bulbous with a swollen body-whorl. The ground color is gray or milky white. Instead of a network, dark spots are well scattered over the surface.

2. Oliva juliettae Duclos. Formerly considered a variety of *venulata*, this species has a characteristic thick lip and a vivid green ground color, overlaid by a pattern of dark arrow-shaped spots arranged in longitudinal rows. Synonyms are *Oliva porcea* Marrat; *O. mariae* Duclos; *O. graphica* Marrat; *O. timoria* and *O. timorensis* Duclos.

3. Oliva incrassata Humphrey, the Angled Olive, is not angled at the shoulder in the juvenile state. Young shells resemble *Oliva spicata venulata* in their markings, but can be distinguished from the latter by the pink tinge of the lip and columella. Adult shells usually have a ground color of creamy-white or light yellow, overlaid by brown spots and several longitudinal rows of black blotches.

Two interesting color varieties occur at San Felipe, W. Mexico, at the northern end of the Gulf of California. One unnamed variety is orange in color and devoid of markings. The other, *Oliva incrassata nivea* Pilsbry, is white. The type was described from a shell with a slight trace of dark. Recently, however, an entirely white specimen was collected alive at San Felipe by Mrs. Milton Zim of the Pacific Shell Club, Los Angeles.

In the literature, the Angled Olive is frequently referred to as *Oliva angulata* Lamarck.

4. Oliva peruviana Lamarck is restricted to the west coasts of Chile and Peru. Five varieties have been described.

a. *Oliva peruviana livida* Johnson is creamy-white in color.

b. *Oliva peruviana subcastanea* Vanatta is light brown.

c. *Oliva peruviana castanea* Johnson is dark brown.

d. *Oliva peruviana fulgurata* Martens is streaked longitudinally with lightning-like brown stripes on a cream-colored background.

e. *Oliva peruviana coniformis* Philippi has a reduced spire, with swollen body-whorl and angled shoulder.

The typical *peruviana* is covered with brown spots on a light background.

5. OLIVELLA UNDATELLA Lamarck varies in color and in the pattern of its markings. Some shells are nearly white, others are almost entirely brown. Most of them are patterned with zigzag, longitudinal brown stripes on the body-whorl, often arranged in two broad bands around the shell. Another pattern shows large, dark, triangular flames on a light background. *Olivella nedulina* Duclos is a synonym.

6. OLIVELLA VOLUTELLA Lamarck is usually unicolor and may be yellowish or blue-gray or brown. A variety *Olivella volutella zonalis* Lamarck is white with several wide, brown revolving bands, two on the body-whorl and one on the spire. *Olivella rasomola* and *O. selasia* of Duclos are synonyms of the typical form, while *Olivella zanoeta* Duclos represents the variety *zonalis.*

7. AGARONIA TESTACEA Lamarck. Ground color varies from light-gray to brown, often with a bluish-cast. Frequently marked with zigzag longitudinal brown streaks.

The other members of the olive family on the tropical West Coast show but little variation in shape or color. They are the following species: Oliva porphyria L., Oliva kaleontina Duclos, Oliva spledidula Sby. Olivella columellaris Sby., Olivella dama Mawe, Olivella gracilis Brod. & Sby., Olivella inconspicua C. B. Adams (O. myriadina Duclos), Olivella tergina Duclos, Olivella versicolor Marrat, Olivella petiolita Duclos, Olivella anazora Duclos. Of this group, *Oliva kaleontina, Olivella inconspicua, O. versicolor* and *O. petiolita* are rather uncommon.

TWENTIETH ANNUAL MEETING, AMERICAN MALACOLOGICAL UNION

BY MARGARET C. TESKEY, Secretary

The second-largest crowd in A.M.U. history assembled in Durham, New Hampshire on August 16th, 1954 as guests of Dr. George M. Moore and the University of New Hampshire.

The weather was perfect, the setting was delightful, and lobster was king! Over the three-day period seventy-eight persons, members, their families and guests, enjoyed every moment as the clock rolled around and carefully planned events fell neatly into place.

The program was varied: registration, brief opening session followed by scientific papers, the evening meal a picnic by the sea where an especially low tide made collecting easy, an early morning collecting trip, papers in the afternoon, a shore dinner de luxe as guests of General Frank and Dr. Jeanne Schwengel . . . and so it went. As always, time passes too quickly and only the prospect of meeting another year (New York City) kept farewells in a cheerful vein.

Among the business matters transacted by the Executive Council was the act of attaching a by-law to the newly adopted Constitution whereby the membership dues are raised to two dollars per year, additional members of a family, one dollar each. This change was most necessary, since rising prices have made the old assessment inadequate to meet expenses. A corresponding change in the life membership fee (to forty dollars) involves a change in the Constitution itself and will be voted upon by the membership as a whole.

The following officers were elected to serve for 1954–55:

President, Morris K. Jacobson;
Vice-president, Allyn G. Smith;
2nd Vice-president, Ralph O. Fox;
Secretary-treasurer, Margaret C. Teskey;
Councillors-at-large, R. Tucker Abbott;
Anthony D'Attilio;
Yoshio Kondo;
Ruth D. Turner.

NOTES AND NEWS

Cyclinella tenuis (Recluz) in the vicinity of Charleston, S. C.—On March 21, 1954, I found on Magnolia Beach, on the northeast coast of South Carolina, perfect *Cyclinella tenuis*

(Recluz) in abundance. In 1882 Wm. G. Mazyck found a perfect specimen on the neighboring beach of Pawley's Island. In the intervening years many single valves were found, ranging from Sullivan's Island, near Charleston, to Magnolia Beach. As none of the authorities mention the *Cyclinella tenuis* occurring on South Carolina beaches, it seems worth while making the report. Below is a list of dates and findings of this species, taken from the records of the Charleston Museum.

1882. 1 fine specimen. Pawley's Isld. (W. G. Mazyck, p. 28 his list S. C. shells 1913)
1929, 9/12–13. 1/2, broken. Pawley's Isld. (Mrs. E. C. House & E. B. Richardson)
1929, summer. 1/2. Isle of Palms (near Charleston). (Mrs. F. H. Horlbeck)
1929, 10/20. 1/2. Pawley's Isld. (Museum party)
1931, 5/17. 5/2. Pawley's Isld. (E. B. Chamberlain & E. B. Richardson)
1931, 9/7. 2/2. Isle of Palms. (E. B. Richardson)
1931, 9/1–4. 4/2. Magnolia Beach, near Murrell's Inlet. (E. B. Richardson)
1932, 4/15. 1/2. Folly (near Charleston). (E. B. Richardson)
1932, 12/1. 1/2. Isle of Palms. (E. B. Richardson)
1933, 9/7–9. 4/2. Pawley's Isld. (E. B. Richardson)
1934, 7. 1/2. Dewees Isld. (E. D. Porcher)
1935, 10/1. 5/2. Magnolia Beach (Birnie's Beach). (E. B. Richardson)
1940, 2/7. 1/2. Sullivan's Isld. (O. J. Muller)
1940, 4/18. 1/2. Magnolia Beach. (Jim Doctor)
1940, 8. 1/2. Pawley's Isld. (Mrs. J. Kaminski)
1940, 11/17. 3/2. Pawley's Isld. (E. B. Richardson)
1948, 10. 1/2. Pawley's Isld. (Susan A. Bennett)
1954, 3/21. In quantity, perfect. Magnolia Beach. (Susan A. Bennett)

—Susan A. Bennett, 37 Legare St., Charleston, S. C.

ANSP Monograph 8: Pliocene Mollusca of Southern Florida. *Addendum & Corrigendum.*

Subgenus *Bambusum* Olsson and Harbison, 1953

Type by original designation, *Caecum coronellum* Dall (Olsson and Harbison, Acad. Nat. Sci. Phila., Mon. 8, p. 11).

The description of *Bambusum,* proposed as a new subgenus of *Caecum,* was inadvertently left out during the printing of

our monograph on the Pliocene Mollusca of Southern Florida (Mon. 8, Acad. Nat. Sci. Phila., p. 319). This omission is here supplied.

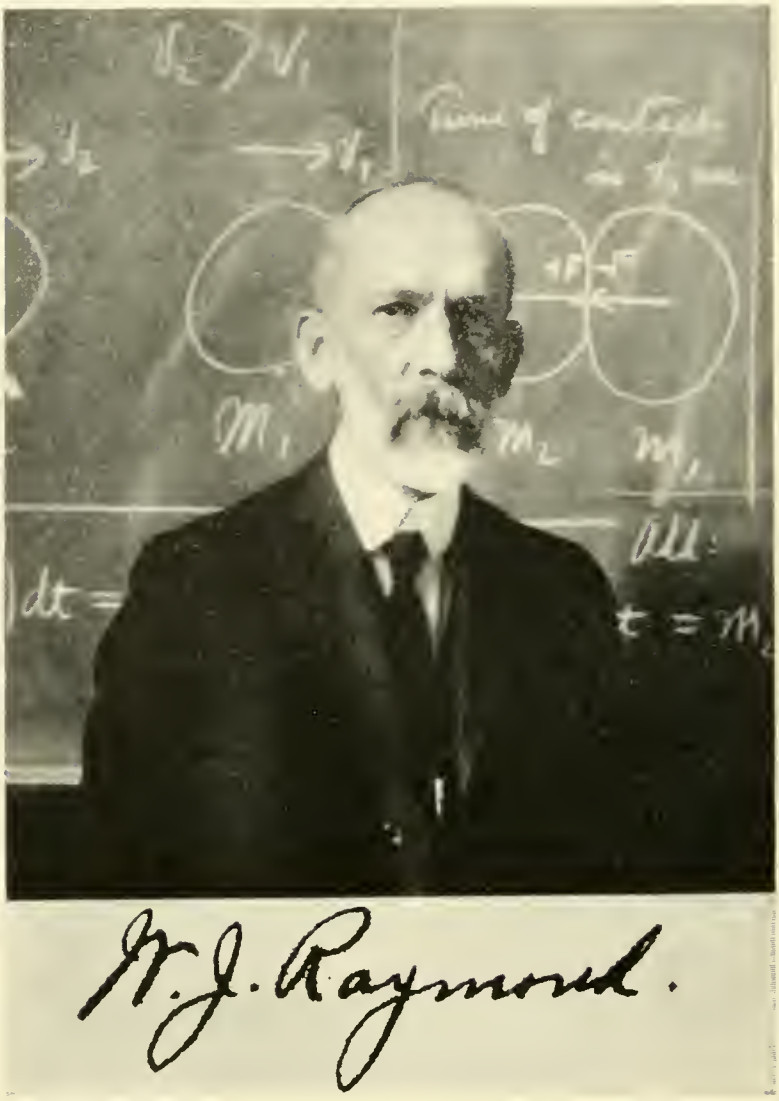
Adult shell relatively large, curved, with little or no taper, the apertural end thickened by a stout collar with a sharp or coarsely serrate edge. Sculpture consists of weak or strong, longitudinal and circular riblets. Posterior plug a flattened or cap-like plate with a short, eccentric mucro.

We take this occasion also to change the name of *Noetia ponderosa macneili* Olsson and Harbison, 1953 (Mon. 8, p. 42), preoccupied by *Noetia macneili* Marks, 1951 (Bulls. Amer. Pal., vol. 33, No. 139, p. 323), to *Noetia ponderosa locklini* Olsson and Harbison.—A. A. Olsson and A. Harbison.

Note on the flying behavior of certain squids: *erratum*.—With the thought that you would wish to be advised of errata inadvertently appearing in Nautilus, we call to your attention that the above-mentioned paper by Arata, Vol. 68, No. 1, July 1954, is shown as Contribution No. 126 from the Laboratory, but that this should be Contribution No. 125.—Stella Pogany, for: F. G. Walton Smith, Director.

Additional food mollusks of the Wampanoag Indians.—Since the publication of our paper on "Utilization of marine life by the Wampanoag Indians of Massachusetts" (Speck, F. G. and R. W. Dexter. Jour. Wash. Acad. of Sci. 38: 257–265, 1948), information has come to hand on the use of two additional species of mollusks as items of food. These are the horse mussel (*Modiolus modiolus*) which was used in making chowder and the rock snail or dog winkle (*Thais lapillus*) which was boiled and the flesh extracted with a pin-like utensil. —Ralph W. Dexter, Depart. of Biology, Kent State University, Kent, Ohio.

Mrs. Kate Stephens, widow of the late Dr. Frank Stephens, died in San Diego at the age of 103. Both she and Dr. Stephens were lifelong members of the A.A.A.S., and will be long remembered as the founders of the San Diego Museum of Natural History. Mrs. Stephens was considered an authority on the algae and shells of the Pacific until disabled by loss of sight in her advanced years. She is mourned by a host of friends.—Leon M. Wright.



William James Raymond, 1865–1947

THE NAUTILUS

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OBSERVATIONS ON DONAX FOSSOR SAY AT ROCKAWAY BEACH, NEW YORK

By MORRIS K. JACOBSON

During the past summer I noticed some peculiar actions on the part of the clam *Donax fossor* which I have not seen mentioned or described in the literature. It might be of some interest and value to make a record of this.

All during the summer in the years when *D. fossor* appears in the sandy beaches of Rockaway, it can be seen and collected when it is uncovered in smaller or larger numbers by the rushing surf. As soon as the clams are uncovered they begin to burrow into the wet sand and in a few moments all of them have vanished. This repeated process caught my attention and I began to devote some time to observing it more closely.

The behavior of *D. fossor* in the rush of water is highly interesting. As soon as it is flushed from its hiding place, the clam extends its foot and its siphons. The foot is extended from the front half of the shell, reaching from about the middle point of the dorsal edge clear around to a similar point on the ventral. The foot is large, thin, the color of clouded mucous except for the tip, which is thicker and has a light buff tinge. The entire foot can be extended to a length equal to that of the shell, and the tip itself is capable of its own farther extension. This tip is very active and moves about excitedly, seeking with the aid of the incurved edge of the foot, to anchor itself against the rush of the water. Simultaneously with the foot, the siphons are exserted, the dorsal siphon (efferent or anal) pointing upward toward the dorsal line, the ventral siphon (afferent or branchial) pointing straight out, in a line almost parallel to the general direction of the ventral edge. If, however, the animal is caught in the backwash of the wave before it has succeeded in anchoring itself, it is turned so that its long axis

is parallel to the rush of the water, the wide posterior section facing in the direction of the current. As this is taking place, both siphons turn sharply toward the umbo, the dorsal siphon lying in direct contact with the posterior edge of the shell and the ventral siphon lying close alongside the latter. The siphons turn either to the left or the right, depending upon which valve the shell happened to fall. This position of the siphons is maintained until the foot finds a secure purchase in the sand. Once this has happened, the siphons surrender the curved position, assume momentarily the "relaxed" position (dorsal upward, ventral straight out) and are then immediately withdrawn. After a few preliminary wriggles while the foot is being further inserted in the sand, the shell upends and in six to ten convulsive jerks (rarely as much as thirteen), lasting from two to four seconds, it disappears. At times I have observed *D. fossor* acting in a like manner in the upsurge of a wave, but in this case the shell, instead of having the posterior section facing the ocean, has it facing the beach and the animal burrows in in this position. Occasionally the shell, in the downrush of the water, is left in a small tide pool formed at the base of the jetty poles. In this case the siphons assume the "relaxed" position and the clam remains in this posture for some time before withdrawing the siphons and burrowing in.

Now and then, when the receding wave is weak, the clam does not assume the position perpendicular to the wave line, but remains more or less parallel to it. When this happens the siphons remain in the "relaxed" position until the moment the burrowing begins, when as usual they are withdrawn. When the current is at its roughest and the clam is hurled about, the siphons are exserted but do not curve umbo-ward. This curving takes place only when the receding water has somewhat slowed down and the clam has a chance of securing an anchorage.

When one has watched the behavior of the clam for some time, it becomes difficult to avoid the opinion that the siphons are being used either as a steering organ, to help turn the shell perpendicular to the wave line, in which case it is being aided by the elongated wedge shape of the valves, or as a braking organ to help halt the shell in its rush and to enable the foot to obtain a purchase in the sand, or as both simultaneously. Even though

I believe the second of the two conjectures to be the sounder one, we still have here a most unique function for these tubes. It can be argued that the siphons are turned umboward in an attempt to keep them from being damaged on broken bits of shells and pebbles as the shell is being swept along. But if such is the case, it is much more likely that the siphons would be entirely withdrawn into the shell. Besides, if this turning is indeed for protection, it is not clear why the dorsal siphon, which curves up near the posterior edge of the shell, needs to be better protected than the ventral siphon which lies posteriorly alongside it, since both are equally vulnerable.

If we try to seek a reason for the actions just described, we might find an answer in a report by Mori (1938) on the behavior of *Donax semigranosus* Dkr. (in his paper printed *D. semignosus*) on the coast of Okinosu in Tokusima-si, Japan. He found that *semigranosus* lived in largest concentration in the area limited seaward by the line which represents the limit of beach that is continually under water (this line moves with the tide), and landward by the line reached by the outmost lapping of the waves. (See his table I.) It is clear that to maintain this position, the mollusk has to migrate with the rising and falling of the tide, which, according to Mori it does for a distance of 3 to 6 meters at neap tide and as much as 30 meters at the spring tide. In the case of *D. fossor,* which also apparently engages in such a migration, at least during the summer months, the distance averages roughly 20 feet.

In this connection, I have observed two factors that enable *fossor* to maintain its position in the changing tides. Since the shell has to be flushed from its subsurface position by the rushing water, it never takes its place at the very tip of the advancing surge like a bit of flotsam, but is usually a short distance behind the van, where, should it stop at this point, it would probably be reached by a succeeding wave even in a falling tide. Similarly it usually succeeds in anchoring itself during or just after the interval between the onrush and the backwash of the wave, and hence occupies a place in front of the line that is continually covered by water. By these two devices it succeeds in keeping itself from being abandoned on land by the receding tide on the one hand, and driven to deeper water on the other. Eva Stoll (1937) describes certain motions of *Donax vittatus*

Da Costa that enable it to creep forward or to leap backward in order to escape from an unfavorable environment (rocks etc.) upon which a chance wave had thrown it. I have never observed this motion in *D. fossor* in Rockaway and believe that its entire migration is accomplished by wave action alone. Here it might also be noted that when the habitat of *D. fossor* is given as "near the ebb line" (Alexander 1941, p. 127) that is only part of the truth.

Mori reports that *semigranosus* leaps from the sand in advance of the wave and is then washed up or drawn back to a different location. He was able to trick the clams into coming forth by simulating the characteristics of a breaking wave: he sprinkled water about, scraped the sand with his foot and rapidly rotated a can in which sand and a *Donax* had been put. All these attempts to rouse *D. fossor* in Rockaway remained fruitless. I have at times observed it to "leap" up from below the surface so that in one jerk it had its shell half uncovered, but since this occurred mainly at the jetties where *Donax* and its chief associate, the sand crab (*Emerita talpoida* Say) were concentrated in unbelievable numbers, I concluded that *D. fossor* did this to avoid an obstructing crab or another clam. However, it is entirely possible that this leaping from the sand does occur as the wave passes over the buried clam. But since the water at this moment is completely roiled by loosened sand, observation is impossible. It would be of value to experiment further to settle this point.

It is interesting to note the position assumed by the Japanese *Donax* as drawn by Mori in his figure 13b. Here too the shell orients itself with its longer axis parallel to the rush of the water, the wide posterior end facing in the direction of the current. The siphons however, are only little exserted, the ventral one about half as much as the dorsal, and both pointing straight back, neither assuming the curved position of *fossor*. It would be of great interest to observe the behavior of other *Donax* species throughout the world.

The contrast between the behavior of young *Spisula solidissima* Dillw. and *D. fossor* is significant. The former is a true sand dweller and being flushed from its shelter represents a tragedy for it. It lies helplessly in the open or makes a few feeble attempts to dig in. Unless by chance it succeeds in

getting back to deep water, it dies. In the waves and rush of water, it withdraws both siphons (united to the tip), and the foot, and is aimlessly thrown about like a dead shell.

The *Donax,* however, seems to have chosen its restless environment, and its behavior in it lies well within its natural mode of life. This can be seen in the amazing success it has in keeping alive in this dangerous ecology. At its peak, *D. fossor* in numbers comes directly after the *Spisula* and perhaps *Mytilus edulis* L. in Rockaway. Yet dead *Donax* shells are surprisingly rare whereas the others clutter up the beaches the year round.

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THE OCCURRENCE OF POLYGYRA TEXASIANA (MORICAND) IN ALABAMA

By HUGH C. RAWLS

Department of Chemistry, The Citadel

The purpose of this paper is to report the occurrence, in west-central Alabama, of *Polygyra texasiana* (Moricand), a species heretofore not recorded from that state.

Hinton (1951) recorded this species as *Polygyra triodontoides* (Bland), with the information that the shells were found in abundance in open prairie-land in Hale County, Alabama. Subsequently, the writer (1953), while studying Hinton's specimens, noted that the aperture of each shell presents an althogether different picture from that of *P. triodontoides:* the teeth are similar, close together, and almost completely basal, whereas those of *P. triodontoides* are dissimilar and widely separated. In addition, the spire is quite depressed, whereas that of *triodontoides* is distinctly elevated. The features thus noted were

strongly suggestive of *Polygyra texasiana*, and upon comparison with topotypes of that species the writer has concluded that Hinton's specimens are indeed shells of *texasiana*. Sixty specimens from one locality in Hale County were measured and found to be separable into two sizes. Larger shells average 5.0 mm. in height and 10.0 mm. in diameter; smaller specimens average 4.0 mm. by 8.0 mm. Both large and small forms have H/D indices of 0.5, as do individuals slightly intermediate in size. Pilsbry (1940) notes that *texasiana* is variable in size, and states that, in shells from single colonies in Texas, the diameters range from 7.6 mm. to 10.9 mm. Extreme diameters of Alabama specimens are well within this size range, and all other morphological features are those of typical *texasiana*.

According to Pilsbry (1940), the range of *texasiana* extends from Brownsville and San Antonio northward and eastward through Texas into Oklahoma, western Arkansas and Louisiana. The occurrence of this species in Alabama represents an eastern extension of its known range, and constitutes a new state record.

The three known localities in Alabama are very close together, within six miles of each other. Such proximity, coupled with the fact that *texasiana* has not been found elsewhere in the state, suggests that this species may have been introduced. Hinton (1951) points out that the localities in which he collected are in an area where livestock is imported from Texas, and that the possibility does exist that the snails were introduced in herbage used for feed during the transport of cattle. This seems rather unlikely to the writer, since no other foreign shells were taken in the localities in which *texasiana* was found.

The discovery of *Polygyra texasiana* in Alabama should not be surprising; the localities are within the limits of the Alabama Black Belt, which is a typical long-grass prairie which shows rather distinct western affinities. Several other species have ranges which extend throughout the Gulf Coastal Plain, and the discontinuity between the Alabama localities and the previously published range of *texasiana* simply indicates the need for further work in the intervening states.

Alabama records: Near the Hale-Marengo county line, just south of Allenville on U. S. 80.

Prairieville, at the junction of U. S. 80 and Ala. 13. Four miles north of Faunsdale, on Ala. 99.

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NOTES ON THE GENERA LANX AND FISHEROLA (PULMONATA)

By J. P. E. MORRISON [1]

The Division of Mollusks of the United States National Museum recently received for identification two lots of *Fisherola*. One lot of more than a dozen specimens with the animals was collected by members of the Idaho State Fisheries service, from the Snake River. These were sent to us by Dr. A. F. Bartsch of the Division of Water Pollution Control of the U. S. Public Health Service. The second lot, of more than 100 specimens with the animals, was collected and submitted to us by J. J. Davis, biologist of the Hanford, Washington, laboratories of the General Electric Corporation. These were collected by him from the Columbia River at McNary Dam, Benton, Co., Washington. In the course of preparation and identification of these lots, all the shells of specimens of the Family Lancidae in the United States National Museum collections were reexamined.

H. B. Baker has published rather complete studies of the anatomy of *Lanx* (Proc. Cal. Acad. Sci. (ser. 4) 14: 143–169: 1925), together with figures of the radula and jaw of *Fisherola*. The superficial examination of these available animals of *Fisherola* shows them to agree in general external characters with those of *Lanx*. Specifically, *Fisherola* agrees with *Lanx* in completely lacking a gill as Pilsbry (Nautilus 38: 73–75: 1925) has stated, and in the right posterior position of the anal opening in the mantle edge.

[1] Published by permission of the Secretary of the Smithsonian Institution.

Baird was apparently the first observer, and for many years the only one, to put on record the true orientation of *Fisherola* shells. In his 1863 description of *kootenaiensis,* Baird said: "vertice antico." Later authors gave the wrong orientation to the shells for many years. It remained for Pilsbry (loc. cit., p. 74) with the animals available, to correctly give the position of the apex (fundamentally anterior to the middle of the shell —in the midline) as a family character. Some of the old individuals of *Lanx* in the United States National Museum collections have shells with the apex a little posterior of the middle

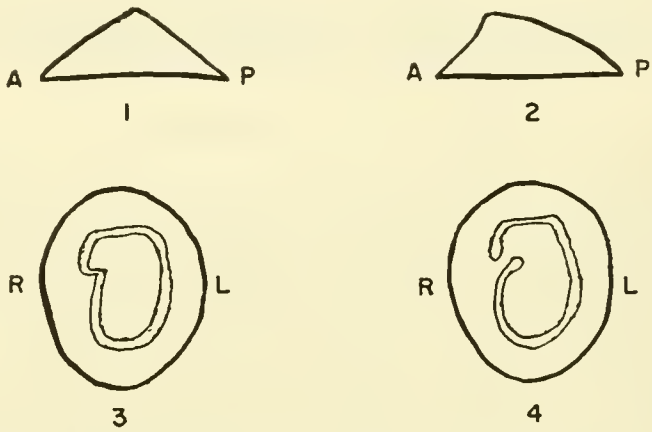

Fig. 1. *Lanx,* diagram of shell outline (left profile).
Fig. 2. *Fisherola,* diagram of shell outline (left profile).
Fig. 3. *Lanx,* diagram of muscle scar on interior of shell.
Fig. 4. *Fisherola,* diagram of muscle scar on interior of shell. A. anterior; P. posterior; R. right; L. left.

of the shell by actual measurement. Therefore we believe subcentral is the best word to use in describing the position of the apex of the *Lanx* shell (fig. 1).

Fisherola shells differ externally from those of *Lanx* in the position of the apex, notably forward of the middle of the shell outline (fig. 2). The anterior slope is usually concave. Baker (loc. cit., pl. 11, fig. 2) has figured the (columellar) muscle ring by means of which the animals of *Lanx* are attached to their shells. Fortunately for identification involving only the shells, the muscle scars on the interior of the shells are always present and characteristic for the Family Lancidae. Careful examination of these muscle scars will serve as a positive means of separating the shells of the genus *Fisherola* from those of

Lanx. A diagram of the shell interior and muscle scar of *Lanx* shows a "faulted" step in the middle region of the right side of the ring (fig. 3). In contrast, shells of *Fisherola* show a condition matching the animals, with a distinctly open gap, wider than the width of the muscle (or scar), a little forward of the middle position on the right side of the muscle ring (fig. 4). In addition, this muscular ring (or scar) is more notably narrowed over the anterior (head) position of *Fisherola* than it is in the genus *Lanx.* The muscle scar picture of *Fisherola* shells is a mirror image (right and left reversed) of the European genus *Pseudancylus,* and is strongly reminiscent of that of *Siphonaria* shells. The *Fisherola* shells of course are not asymmetrical, as are those of *Siphonaria,* and *Fisherola* has this gap in the muscular ring for the passage of the intestine and lung complex, instead of for a siphon. This is very probably a functional convergence of the pattern of muscle scars, since we know by the other anatomy that the Lancidae are only indirectly related to the Siphonariidae.

The geographic distribution of the Lancidae is most interesting. To the best of our knowledge, the genus *Fisherola* is confined to the Columbia River drainage system. Pilsbry (loc. cit., p. 75) has suggested that all the forms of *Fisherola* may belong to the species *nuttalli.* The material in the United States National Museum collections is insufficient to completely prove this point. According to our material, the named form *lancides* from the Snake River may be a good subspecies. All the material we have seen from the rest of the system agrees with *nuttalli,* although individually variable. As the type locality of *kootenaiensis,* Baird gave the Kootenai and Spokane Rivers. The Kootenai River is here selected as the restricted type locality, so that if the form from that river (a form we have not seen) is different, the name will continue to be available subspecifically. Our material from the Spokane River is not distinct enough on shell characters to be considered different from *nuttalli.*

The generic distinction of *Fisherola* shells is proven in the fossil record also. In the United States National Museum collections, there are two specimens of *Fisherola nuttalli lancides* Hannibal, from the "late Tertiary" fossil deposits at Minidoka,

Idaho (U. S. Geol. Surv. No. 4411) collected years ago by Dr. G. K. Gilbert. These specimens show the characteristic muscle scars perfectly, and prove that *Fisherola* has been in the Columbia (Snake) system since at least these "late Tertiary" times.

The species of *Lanx, s.s.*, are only known from the Coastal river systems to the south of the Columbia. The Umpqua River system of Oregon is the locality of *Lanx subrotundatus* Tryon. The Rogue River has a form in it apparently identical in shells to *subrotundatus*. We have not seen enough material to prove or disprove this apparent identity. Does one species occur in more than one river system, or does each river system have a biologically distinct species? The Klamath River system is the range of the species *altus* Tryon. The upper Sacramento River is the true locality of *Lanx newberryi* Lea, according to Pilsbry (loc. cit., p. 75). With Lea's type material in front of us, and no other matching specimens collected and added to the United States National Museum collections since, except from the Sacramento River system, we are inclined to agree wholeheartedly with this correction of the locality by Pilsbry.

The section or subgenus *Walkerola*, which differs from typical *Lanx* only by the depressed shell shape, is a special development only known from the southern part of the range of the genus *Lanx*. *Lanx* (*Walkerola*) *klamathensis* Hannibal, as its name implies, is from the Klamath System. *Lanx* (*Walkerola*) *patelloides* Lea is from the upper Sacramento River drainage. This species may include *hannai* Walker (Occ. papers, Mus. Zool., U. of Mich., No. 165, p. 6, pl. 3, figs. 1–4: 1925) as a synonym. In this connection, the following problems of species characters or variation is worthy of attention and study. *Lanx klamathensis* is unicolor, sometimes pale, but one lot seen, USNM No. 334388, said to be from L. Klamath, Klamath Falls, Oregon (W. Westgate) contains 5 specimens typical of *klamathensis*, and 2 specimens with the spotted color pattern of *patelloides*. *Lanx patelloides* (Lea) is characteristically so spotted like a *Patella* shell, that Tryon disdained to include it in his 1870 Monograph of Freshwater forms. We do not blame Tryon for being so suspicious of the origin of this species, at a time when incorrect locality data was much more of a problem than it is

today. Since he did not have personal experience as to the true habitat, it just didn't look right to him.

Now the problem is—are there only two species of *Walkerola:* (1) *klamathensis* (unicolored) and (2) *patelloides* (spotted), with a few specimens mixed (incorrectly out of place) as regards locality data? Or—do both species occur in both river systems?? Or—are there 4 species: *klamathensis* (unicolored), and another species (variegated) from the Klamath River system; with *hannai* Walker (unicolored) and *patelloides* Lea (variegated) both from the upper Sacramento River tributaries???. More material must be collected, and the animals critically examined before this problem will be permanently resolved. It may not be fundamentally important, but it certainly will be interesting to know whether or not the family Lancidae is such an old relict type, that every species is now endemic, restricted to a single river system.

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A NOTE ON AMYGDALUM PAPYRIA CONRAD IN MARYLAND WATERS OF CHESAPEAKE BAY

By J. FRANCES ALLEN

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Amygdalum papyria Conrad, the paper mussel, occurs in Texas and Maryland to Florida (Abbott 1954). This genus has been described as thin and smooth, often with colored cobwebby designs, and this particular species as being elongate

and smooth, glistening, fragile, and colored a delicate two tone bluish green and soft yellowish brown, with the interior an iridescent white (Abbott 1954).

Chesapeake Bay is represented in the collections of the United States National Museum by specimens from five localities. Mr. Ralph W. Jackson found them in the Little Choptank River at Town Point (Cat. No. 361668), and at Dailsville (Cat. No. 361669), both in Dorchester County. These two lots vary in color from yellowish brown to various shades of green and some from each locality have faint markings. He also collected this same species (Cat. No. 348954) from sea grass on the bank of the Choptank River at Sandy Hill. These had the same general appearance as those from the Little Choptank. During the Potomac River Oyster Survey carried out by the U. S. Fish and Wildlife Service in 1943, specimens (Cat. No. 518856) were collected from Chicken Cock Bar in the St. Mary's River, St. Mary's County. They were yellowish to green with no markings. Apparently the first collected at Crisfield was a single yellowish green specimen with a few irregular lines (Cat. No. 474091), found by Dr. Waldo Schmitt.

In 1951, the author found two of these small mussels attached to submerged vegetation at Ape Hole, Pocomoke Sound. Both were pure green in color with no cobweb-like markings and each measured 7 mm. in length. In July 1953, the same species, but of noticeably different color, was collected from the Little Annemessex River. During the same summer, and again in 1954, an effort was made to find additional representatives from Pocomoke Sound and the Little Annemessex River to determine the nature of their distribution and abundance in this area of the Bay.

Fifty-two specimens mostly attached to *Ruppia maritima* (Linn.) and to a lesser degree on *Zannichella palustris* (Linn.) occurred off shore in the Little Annemessex River, near the entrance to the small boat harbor at Crisfield, and just below the entrance to the Little Annemessex Canal (Allen 1954a). They ranged in length from less than 3 mm. to 14.5 mm., averaging 10.5 mm. Their color varied from bright blue-green with no markings to pale green, almost olive, with a few brown markings; to pale green with numerous brown markings; to dark brown or black with dark markings and with the periphery of

the shell, a distinct green. Occasionally, the umbo area was brown and devoid of any markings. Sometimes the markings varied in number from few to many, with some lines being very fine while others were wide and dark.

Eight specimens were found attached to grass off shore from the McCready Memorial Hospital, located at the junction of the Little Annemessex River and the Annemessex Canal (Allen 1954a). The largest one, 8 mm. in length, was extremely dark, almost black, with markings and a green tinge at the edge of the shell; while a second one, 4.5 mm., was dark brown with no markings. Of the six less than 3 mm., one was pale green to almost buff with indistinct marks; another was brown with no marks; and the other four were nearly white with neither color nor any indication of lines.

For collections in Pocomoke Sound, an ordinary crab scrape was used to remove the vegetation from the bottom, a two-gallon bucketful of which was retained for examination. The plants were washed twice, the washings screened to remove specimens and the vegetation was observed closely for additional mussels still attached. A small dredge net was also used.

Collections were made in Pocomoke Sound from Ape Hole to Cedar Straits. Three specimens collected from the general area had different color variations: one was green with irregular brown markings; one was dark brown only; and the other was brown at the umbo region, changing to light green and then becoming darker at the periphery. A dredge net tow extending from near the entrance of Ape Hole going inshore toward the harbor secured 12 specimens ranging in length from 6.6 mm. to 14.6 mm., averaging 10.5 mm. The color differed from entirely black and brown with black markings to pale green with brown markings, and pale green with markings and a black periphery of the shell.

At Lower Ape Hole, six specimens averaged only 5.05 mm. in length while an additional eleven specimens were 3 mm. or less. Here all types of color variations were evident. However, the edge of the shell was often dark brown or even black. Nearly all individuals were attached to *Ruppia maritima* and the bottom here is very black mud. In June 1954, three specimens measuring in length 1 mm., 3.2 mm. and 4.7 mm. respectively were found in this same locality. The first one mentioned was entirely

tan in color, and the other two, found beneath *R. maritima* above the high tide mark, were almost black with a total absence of lines.

The largest mussel, 18.9 mm., was found at Ware Point, the average length of the twenty specimens collected from this locality being 12.32 mm. Color variations included all types previously mentioned, also some brown shells with a pinkish or red cast which shaded to green with dark markings, so intense that the shell was dark at the edge, where in similar coloration the edge was green.

Only one specimen, 12 mm. long, green with brown markings, was found at Watkins Point. At Broad Creek, 3 specimens in shades of brown, one with markings and two without, and lacking any green were collected. One olive colored specimen with brown markings measuring 10.4 mm. was found off Long Point.

The following localities were also sampled but no representatives of this species were found: Manhoe Knoll, Big Island, Oyster Shell Point, and Green Harbor.

Some of the larger specimens in the collection at the National Museum were measured for length. One mussel from Sandy Hill measured 24.4 mm., while the larger ones from Town Point measured 27.1 27.3, 28.5, and 31.3 mm., respectively.

Of the collections reported here, all specimens were in general much smaller than those previously collected except for the one collected by Dr. Schmitt. The color of those mussels from Pocomoke Sound and from the Little Annemessex River show a wide assortment of color shades, from blue-green to olive, to yellow green, to an intense green; markings are tan to light brown, to dark brown or black. In some cases, there is a complete absence of green or of markings. The markings themselves, may be either so numerous or so wide that the shell appears to be black or brown unless it is examined under magnification. Overtones of red, rose, and pink occur on the darker shells. Occasionally, the irregular markings become circular lines which follow the contour of the shell.

From preliminary observations, it appears that color, size, and distribution are greatly influenced by environmental characteristics. The shade of green tends to be present in shells from less muddy areas than are the areas from which the dark shells were collected. In the localities visited, these mussels are usu-

ally found attached to *Ruppia maritima* but apparently they are not abundant and their distribution is spotty. The genetic influence on color is well recognized but since it has been established that the substratum (Allen 1954a, 1954b) and other environmental factors influence the color and color shades in bivalves, it seems that the possible effect of habitats on the wide differences in these forms is at least of interest. The periostracum is secreted by the mantle and it is the periostracum which gives this form its variety of color shades and patterns of markings.

The author is indebted to Dr. J. P. E. Morrison of the U. S. National Museum for permission to examine the collection of the Division of Mollusks. Appreciation is expressed to Mr. Howard Tyler and to Mr. Brice Tyler for the use of their boats and for their assistance in collecting.

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THE OCCURRENCE OF ESTUARINE BIVALVES IN AN UNUSUAL HABITAT

By J. FRANCES ALLEN

Department of Zoology, University of Maryland

For several seasons the Crisfield Crab Co. of Crisfield, Maryland has been shedding blue crabs, *Callinectes sapidus* Rathbun, in indoor tanks. The building housing this operation is constructed over the waters of the Little Annemessex River which is adjacent to Tangier Sound of Chesapeake Bay. A continually running supply of water is pumped through rubber tubing which at the intake has a screen with .223 inch openings, through plastic pipe into tanks made of wood. These tanks drain into

wooden troughs which are six inches wide and four inches in depth. Approximately two and one half to three inches of water was flowing through these drains at all times. A certain amount of sediment settles out in these drains resulting in the formation of a shallow mud-sand substratum, largely mud.

In the spring of 1954, Mr. A. Wellington Tawes made the building available to Dr. R. A. Littleford and the author for experimental studies on crabs. Upon examination, the troughs were found to be almost completely filled with shells of various bivalves. Mr. Tawes stated that the water flow in the tanks had begun on May 1, 1953, and was continuous until the middle of August 1953, when due to hurricane winds, the power failed, the flow ceased, and the plant was closed for the season.

The mollusks found here had obviously been brought in with the water as planktonic larvae and having found a habitat satisfactory for attachment or burrowing were able to survive. They could not have been sucked into the intake as it was two and one half feet from the bottom, a sufficient distance to prevent this. When the plastic pipes were washed out, it was found that they also contained bivalves. Apparently, they simply attached to the pipe rather than to the troughs.

A random sample of shells filling two ten-quart buckets was collected.

Of the eight specimens of *Volsella demissa* Dillwyn, the ribbed mussel, the average length was 12.92 mm., the smallest one being 7.4 and the largest 14.5 mm. *Amygdalum papyria* Conrad, the paper mussel, was represented by three individuals, all of which were small, measuring 7.1 mm., 12.8 mm., and 16.8 mm., respectively. Three oysters, *Crassostrea virginica* Gmelin, measuring 23.1, 29.5, and 31.5 mm. in length were found. The largest one was very fragile and was attached to the upright of the drain where nothing was present to impede its growth. In shape, it was only slightly convex, almost flat, and measured 34 mm. across the valve. The left valve was a very thin shell which was almost impossible to remove from its support. There were tints of gray, rose, and tan in the shell and superficially it did not closely resemble the ordinary oyster.

Of the species collected, *Laevicardium mortoni* Conrad was third in abundance. This is the first time, to the author's knowledge, that the so-called Morton's egg-cockle has been col-

lected from this vicinity. The size range extended from 4.8 mm. through 18.3 mm. It is possible that the mud-sand habitat of the inshore areas is not suitable for survival as this area has been carefully examined and sampled (Allen 1954a).

Mulinia lateralis Say, the dwarf surf clam, was by far the most abundant of the species present. It demonstrated good growth as some were nearly an inch long, 22 mm., although some representatives were small. Their occurrence and size in this habitat are of particular interest to the author for until this occasion, she had collected only two very small specimens, 4.8 mm. and 9.7 mm. long, in Ape Hole of Pocomoke Sound, and Somers Cove of the Little Annemessex River, respectively. Since *M. lateralis* apparently prefers sand (Dr. J. P. E. Morrison, personal communication), the high mud content of the inshore substratum in the areas previously examined was not conducive to survival and growth. Three malformed specimens were found among the normal forms. Both valves of each clam were deeply cleft and superficial examination would not necessarily indicate that they are members of this species. The abnormality was so similar in each case, that they looked like a different type.

The angel wing, *Crytopleura costata* Linn. (following the generic name as designated by Turner, 1954, rather than *Barnea*), was second in abundance. They measured as much as 22.7 mm. in length. Their small burrows riddled the dried mud, and the fact that the posterior of the shell was sometimes curved vertically was due to crowding against the drain. The smallest specimen measured was 5.6 mm. long, but due to their fragility, and the hardness of the dry mud in which they occurred, incidental observations indicated that they were even smaller.

Mya arenaria Linn., the soft clam, was quite numerous. The lengths of 78 specimens ranging from 14.2 to 29.5 mm. averaged 20.93 mm. However, the few smaller specimens measured only 5.2 mm. This clam, as well, exhibited good growth.

The development and growth of these species of bivalves in this unusual habitat is important in several ways. It is now known that the larvae of these forms are present in these waters and conditions are satisfactory or even optimum for their survival and growth, if given a chance. The fact that the habitat

under discussion was available only from the first of May until the middle of August, a period of three and one half months, at most, gives a starting place for life history studies and reproductive cycles in these groups and shows that their growth must be relatively rapid. One fact worthy of note is the total absence of the short razor clam, *Tagelus plebeius* Solander, and of *Macoma balthica* Linn., which are so abundant in the mud-sand substratum of this region (Allen 1954b). Obviously, their spawning periods are not simultaneous with those of the other forms mentioned, for at least some representatives would have survived.

Appreciation is expressed to Mr. A. Wellington Tawes for the use of the facilities described and for pertinent information, and to Mr. Frank Evans for his interest in being sure that the author had examined the drains and for his cooperation for using the facilities made available.

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ESCAPED ESCARGOTS

By DR. W. J. REES

British Museum, London

There are moments in the life of the wanderer far from kith and kin (be he immigrant, explorer, or mere tourist) when some small object or incident brings back instant memories of home. So it was with John Carson, an English immigrant to the Australian State of Victoria in 1849, when he found a slug in his garden which he immediately recognized and greeted as an old friend from his native land. In nostalgic mood he carefully replaced it on the ground, but, within a year, the situation

was radically different, and he spent much of his evenings fighting a losing battle against the hordes, which now threatened the very existence of his garden.

The story outlined above is a familiar one in the history of introduced animals and plants in countries where they are not native. We have, among many others, the prickly pear and the rabbit in Australia, and the giant African snail in the Indo-Pacific—all amply demonstrating the folly of interfering with the balance of Nature, either by accident or design.

Among the many snails which have succeeded in spreading to various parts of the world are several European species. None has been more successful and more widely dispersed than the persecuted dweller in British gardens, the common snail. In its travels it has acquired a large number of vernacular names, but it is as *Helix aspersa* that it is known to naturalists all over the world.

In England, *Helix aspersa* is only a very minor garden pest, but, because of its comparatively large size, it is often blamed for the more serious depredations of the smaller slugs. It is a home-loving creature, spending most of its days in a crevice, to which it returns after foraging expeditions, made mainly at night. During the winter, it may hibernate for six months or more with the mouth of the shell sealed up with a kind of diaphragm (*epiphragm*) of dried mucus. In this state it can exist for over a year, drawing on its reserves of fat and glycogen at a much reduced rate, but once climatic conditions become favorable again, the snail resumes an active life. Similarly, summer dormancy is induced by drought. This ability to lie dormant for long periods during adverse times has undoubtedly played a great part in enabling the snail to survive lengthy trans-ocean journeys in days when travel was more leisurely than now.

Snails are a favorite item in the diet of Latin peoples, and what is more natural than that they should take with them a consignment of *escargots,* hibernating in casks, to relieve the monotony of a diet of salt pork on voyages? It is, in fact, well known that sailing vessels would depart on long voyages carrying no fewer than seven or eight thousand snails of this species. At ports of call what better gift to a fellow countryman, official or priest, than some *escargots* for his table? We do not

have to imagine the sequel as it has been recorded for us by E. L. Layard, an officer of the Consular Service, for Cape Town and New Caledonia, and it is likely to have been repeated at many other places.

Concerning Cape Town, where the mollusc is to-day abundant and a great nuisance in gardens, Layard records: "In 1854 (or 1855, I am not sure which) I was living in the 'Gardens,' that part of Cape Town running up the slope of Table Mountain. I one day noticed in the vineyard attached to my house, on a wall, a cluster of young *H. aspersa.* Of course I knew at once they must be an introduction. Soon complaints were made of vines and vegetables being devoured by snails, and as I was known to be a 'snail collector,' the introduction of the marauder was set down to me. This I at once repudiated, and set to work to find out who had done it. I discovered that some months previously a French man-of-war had been in the harbour and having received much kindness and attention from the French Consul, Monsieur Dastre, had requited it somewhat by presenting him with a little barrel of 'escargots' of which he was very fond. Monsieur Dastre was a wise man! He reasoned with himself—'I'll eat the big ones and plant the little ones'—and chucked them over the garden walls; and they increased and multiplied and filled the land. . . ."

Many years later (in 1879) Layard was able to record finding it for the first time in New Caledonia, "and went off in a spirit of inquiry (seasoned with diplomacy) to Monsieur Luguier [the *Résident*] . . . a little manoeuvring brought round the question, did he like escargots? 'Ah, yes!' and he had lately had a stroke of luck; a French man-of-war had called in and given him a nice lot of them; he had eaten the large ones and had distributed the small ones about the place, and when they grew bigger and had large families, he would have a dish at command."

There seems little doubt that the fondness of the Latin peoples for transporting and importing edible snails was a major factor in dispersal to many places, notably, Haiti (1822); Cayenne (1822); French Guiana, Senegal, St. Helena, and Rio de Janeiro (1837); Cape Town (1854); Mauritius (1873); New Caledonia (1879); and the Seychelles (1880)—in some instances these dates only note the time when the snails were first re-

corded. The original introductions may have been much earlier, and, in this connexion, dare we suggest that *Helix aspersa's* presence at St. Helena goes back to the days when Napoleon was exiled there?

It also occurs at Madeira, the Canaries, and the Azores, but whether imported as edible snails or accidentally with plants is not clear. Entry in soil with plants or among commercial plant products is recognized as one of the easiest ways for the spread of snails—how else could they have reached the mid-ocean islands of Pitcairn, Norfolk Island, and Hawaii? Even more remote are Tristan da Cunha (in the Atlantic) and Easter Island (in the Pacific), but the common snail has reached them and appears to be quite at home.

Helix aspersa has found its way to practically every country in the new world, from Canada in the north to Argentina in the south. Most of the colonies in the Latin-American countries seem to have originated from importations for culinary purposes—many of the records going gack to the middle of the nineteenth century and earlier.

In the United States the snail is now naturalized in no fewer than six states as a result of independent introductions—for food, on account of misplaced zeal by enthusiastic conchologists, and, it is thought, in at least one instance, accidentally with plants. The first colony existed at Portland, Maine, in 1838, but its descendants seem to have disappeared from this locality. It was naturalized in gardens at Charleston, South Carolina, and in New Orleans before 1850, and specimens from Ireland were released at Woods Hole, Massachusetts, in 1883.

The most successful introduction was to California, between 1850 and 1860, where the climate provides ideal conditions for the snail to multiply. A stock of snails from France was brought to San José by a man called Delmas, who released them in vineyards, and he is reputed also to have started colonies at Los Angeles and San Francisco. By the turn of the century the snail was recognized as a pest, and by 1931 it could be found in most of the cultivated areas of California, from San Diego County to Sonoma County.

A report written at this time showed that it had become a considerable pest in citrus groves. The culture of citrus trees involves regular irrigation and mulching of the soil, which pro-

vide ideal conditions under which the snail can breed practically the whole year round, so that enormous populations of the mollusk can become established. These quickly defoliate the trees and injure the fruit, allowing fungi to complete the spoiling of the latter. Control measures, such as hand picking and the use of poison baits, are effective so long as they are maintained.

In the Antipodes, too, this common snail is found in Australia, Tasmania, and New Zealand. There are no precise records of how or when it got to Australia, but it was plentiful around Melbourne in 1879, and later it was found to be equally abundant in gardens at Sydney. It was also known to be naturalized in gardens at Adelaide in 1884, and rapidly spreading, so that by 1924 Sir Joseph Verco was able to say that for many years it had been the common snail of South Australia. From Melbourne it was deliberately imported to Hobart, in Tasmania, about the year 1878, by the conchologist Beddome. By 1884 it was thoroughly acclimatized, spreading by 1890 to many towns on the coast. In more recent times it has been reported from Perth and Fremantle but it appears to be absent from Queensland and the more arid parts of the country.

In Sydney gardens, where *aspersa* is much more of a pest than in England, some interesting observations have been made on its relations with other species. A native carnivorous snail, *Strangesta capillacea,* which is only half the size of a full grown *aspersa,* has acquired a taste for the immigrant, and, once it finds its slimy track, will follow like a bloodhound, finally overtaking and eating it. The meal lasts several days, and if the *Strangesta* remains continuously on a diet of *aspersa* for a month it will die—it is presumed from the cumulative effects of a mild poison in the tissues of its prey. This is not the end of the tale, for there is another actor in the drama, the cellar snail (*Oxychilus cellarius*)—also an abundant British immigrant—which feeds on the young of both species. Whether *Strangesta* will continue to include *aspersa* in its diet, no one can tell, but its final verdict may well be that it is not good eating.

Such preliminary observations merely lift the corner of the veil on problems arising from even a slight disturbance in the balance of Nature.

A FRESHWATER MOLLUSK SURVEY OF NORTH FLORIDA RIVERS

By WILLIAM J. CLENCH

Under the auspices of the University of Florida,[1] a mollusk survey has been conducted of the Jim Woodruff Dam area. The dam is situated at Chattahoochee, Florida on the Apalachicola River and, when completed, will flood areas in Florida, Georgia and Alabama. It is built a few hundred yards below the place where the Chattahoochee and Flint rivers join to form what is known as the Apalachicola River, which continues south to the Gulf of Mexico. Studies on the birds, reptiles, insects and other groups are being made by members of the University of Florida as well as by members of other institutions. Our party in the summer of 1953 consisted of Mrs. Clench, Dr. Ruth Turner and the author. The survey for mollusks was continued in 1954, and was broadened to include several other major streams in northern Florida from the Escambia on the west to the Suwannee on the east. The party this year consisted of Dr. Ruth Turner, Donald McMichael (Australian Museum, Sydney) and the author. Actually the beginnings of this broader survey went back to 1929 when Dr. Peter Okkelberg (now Professor Emeritus, University of Michigan) and I made a survey of the upper Chattahoochee and Flint rivers. Subsequent collecting was also done by Dr. Henry van der Schalie and me in 1933.

The main purpose of the survey during both 1953 and 1954 was to collect mollusks in the area to be inundated when the dam is completed. This will put on record its present fauna and later, other surveys will be conducted to note and record any changes in the biota after lake conditions have prevailed for some time. The year 1953 was a more or less normally wet year. The large rivers were "up" and it was nearly impossible to collect in them. Land shell collecting, however, was good to excellent. In 1954, the south had a drought, its worst in many years with dry conditions prevailing over a wide territory.

[1] Research supported in part by the U. S. National Park Service, in cooperation with the Florida State Museum, the Department of Biology, University of Florida and the Museum of Comparative Zoölogy, Harvard University.

The big rivers were "down" and, what was most unusual, they were clear. This was my fourth attempt to collect in the lower reaches of these rivers. High water during the first three trips prevented anything but casual collecting other than in the smaller streams. The recent trip of 1954 was of a "jack-pot" status. As stated above, all of the big rivers were low and clear and the mollusks were available for the taking.

Years ago the Chattahoochee River possessed a rich biota. Today it is barren, at least for mollusks. We possess many lots of freshwater mollusks for this large river, all collected nearly a century ago, but now all appear to be extirpated. During the war between the states, farming on an intensive scale brought about the destruction of most of its fauna. Rapid erosion of the soil silted the river beyond the capacity of the mollusks to survive and our museum series alone bears mute testimony to its once rich fauna. We have attempted on four trips to collect in this stream but without results. Even in its low and clear stage of the past year our search was completely fruitless at a place some eight miles northeast of Bascom, Florida (Florida, Route 2). Not even a fragment of a dead shell was to be found within a distance of about 500 yards above and below a ferry landing at this point.

The Flint River, however, is still a rich stream and, when at low water stage, is very rewarding for the collector. Silting has been nearly as heavy here but the Flint has a series of huge springs which feed it and aid in keeping the river partially clear, at least diluting the silt sufficiently to keep its fauna alive.

Northern Florida is far different from the central and southern portions of the peninsula. In reality it is the same as southern Georgia and Alabama, having slightly rolling country with pronounced valleys, through which the streams and rivers have cut their way. Coastal Florida, even in the northern Gulf area, is, of course, flat, much of it being freshwater swamp land which gives way to the salt marsh area on the coast proper. Time did not allow investigation of this lowland area. All our time was spent in the northern strip, a country of mixed farming, pineland and some deciduous forests. At nearly every bridge which spans a major stream, little side roads lead down to the water's edge, making it easy country to collect when the rivers are low and clear.

A more detailed account of the fauna will appear at a later date though I would like to highlight a few stations that we found to be of more than passing interest. We made two stations on the Flint River, the first at Hutchinson's Ferry near Recovery, Georgia and the second at Bainbridge, Georgia. Unfortunately these stations will be destroyed when the dam is completed and the area flooded. Both places were visited in 1953 with very indifferent luck as to freshwater mollusks. The story was very different in 1954, the water being down and clear. In both places ledge rock was exposed and there were clear pools of varying depths. Pleurocerids were rather rare but unionids were very abundant. *Campeloma geniculum* Conrad was exceedingly abundant at Bainbridge; we could have filled a bushel basket in an hour.

Rivers, like people, develop personalities when you get to know them. The Chipola River, a tributary of the Apalachicola, is outstanding as such a stream. Its drainage area is narrow and most of its water comes from several large springs which feed it continuously with clear water. Its banks are sandy mud, much of it margined with cypress, and these beautiful trees are usually festooned with Spanish moss. We made six stations on this river; all were rich. At its lower end, just before draining into the Apalachicola, it broadens out into a reach of water known as Dead Lake. Here it is a mile or so wide with ridges of cypress trees running parallel with the shore.

Amblema neislerii Lea has always been considered a very rare unionid, and it occurs only in the Apalachicola system. We found it to be very rare other than at Dead Lake, but here they existed in vast numbers. For that matter I might mention that I have never seen such rich collecting as existed in this locality. Species are not numerous in any of these rivers, at least not when compared with the Coosa or Tennessee river systems, but individuals of one or more species do exist in great abundance. At this station nearly all of the species we obtained occurred in considerable numbers.

The Ocklockonee River differed materially from the Chipola. Its upper reaches above the coastal plain cut a shallow valley, mainly in sandy country. Mud and vegetable detritus were rare and so were gastropods. Only a few *Campeloma* and *Physa*

were found; no pleurocerids at all. Unionidae were plentiful and some of the finest examples of their kind were taken from some six stations made on this stream.

Perhaps I should close with the Suwannee River. Near Old Town, on U. S. Route 19, there was a little roadside park with water and tables. A flight of cement steps took us down to the Suwannee's edge, and the shells were abundant. Our only complaint was that we had to get our feet wet to collect the shells and there was no park attendant to boil out the catch!!!

WILLIAM JAMES RAYMOND, 1865–1947

By ALLYN G. SMITH [1] and WILLIAM K. EMERSON [2]

With the passing of William James Raymond on February 27, 1947, West Coast conchology lost one of its elder students. Professor Raymond belonged to the period of early Pacific Coast resident conchologists and it is due in large measure to the efforts of these avid students and intrepid collectors in the field that our knowledge of the West American mollusca has attained its present status.

Born on July 27, 1865, in Utica, New York, young Raymond was brought by his parents to live in Oakland, California when he was twelve years of age. He spent nearly all of his life in the San Francisco Bay area, attending primary and secondary schools there and continuing his studies at the University of California at Berkeley, where, in 1887, he received the degree of Bachelor of Science with a major in Physics. After graduation he continued his association with the University of California and in 1891 was appointed an Instructor in Physics. With the exception of a year's graduate study at Johns Hopkins University in 1892–93 he remained on the teaching staff of the Department of Physics until his retirement in 1935, when he became Professor Emeritus.

The early research interests of Professor Raymond were devoted to the West American marine and non-marine mollusca, both living and fossil. His extensive field work, plus exchanges

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with contemporaries, resulted in the accumulation of a sizeable collection of mollusks and in the publication of twelve papers on conchological subjects (see bibliography). He was a close associate of Dr. James G. Cooper, in collaboration with whom he published an important paper on the mollusks of the central Sierra Nevada (1890)—the result of a pack trip into the high Sierra. While on this trip Raymond discovered *Sphaerium* [= *Musculium*] *raymondi* J. G. Cooper and *Planorbis* [= *Helisoma*] *subcrenatus disjectus* J. G. Cooper. With Williard M. Wood he published the first list of the mollusks of San Francisco County (1891). His knowledge of the chitons was relied upon by Professor Josiah Keep in the preparation of the section on the Amphineura in the early editions of "West Coast Shells." It also resulted in a published paper on the genus *Nuttallina* (1894).

On the invitation of Professor William E. Ritter, Professor Raymond was a member of an expedition which conducted extensive dredging operations off the coast of southern California between San Pedro and San Diego in 1901 under the auspices of the University of California Marine Biological Laboratory. Raymond was the navigator of this expedition and the mollusks procured were placed in his care for study and later report. From this material he described the following new species: *Trivia ritteri* (1903); *Dentalium vallicolens* (1904); *Pleurotoma* (*Antiplanes*) *catalinae* (1904); and *Pleurotoma* (*Genota*) *stearnsiana* (1904). Unfortunately, the remainder of the dredgings was never worked up and was discovered shortly after his death by the senior author in the process of disposing of the Raymond collection and library at the request of Mrs. Raymond. It is now in the California Academy of Sciences along with other invertebrates taken at the same time but subsequently turned over to the Academy by the University of California Department of Zoology for curation of the salvageable material.

Toward the end of his active interest in conchology, Professor Raymond devoted his research to the West Coast fossil and living turrids. In 1904 he described *Pleurotoma* (*Genota*) *riversiana,* named in honor of Professor J. J. Rivers, first curator of the University of California Museum. This species was from the "Pliocene" [= Pleistocene] of Santa Monica,

California. His final mollusk paper (1906) was an illustrated review of the West American turrids of the subgenus "*Genota*," as he interpreted them. After 1906 his publications were in the fields of electrical measurements, terrestrial magnetism, and harmonic motion.

His private collection of shells was purchased in 1950 by Miss Ruth E. Coats of Carlsbad, California, now permanent secretary-treasurer of the American Malacological Union, Pacific Division.

Professor Raymond's interest in conchology led to considerable correspondence with fellow workers throughout the world. As a result of his field work and his associations with others, several species of mollusks were described in his honor. These include: the aforementioned *Musculium* (1891); an *Odostomia* and a *Turbonilla* by W. H. Dall and Paul Bartsch (1909); a Pleistocene *Eulima* [= *Strombiformis*] by J. J. Rivers (1904); a Miocene *Astralium* [= *Astraea*] by B. L. Clark (1915); a Miocene *Pecten* by B. L. Clark (1915); a Pliocene *Trophon* by C. L. Moody (1916); and a Recent "*Trachydermon*" = [*Cyanoplax*] by H. A. Pilsbry (1894), the latter now unfortunately but properly placed in the synonymy of *C. dentiens* (Gould).

Organizations in which Professor Raymond held memberships included the old American Association of Conchologists, one of the predecessors of the American Malacological Union, which he joined in 1890 as one of its first members; the Society of Sigma Xi; Phi Beta Kappa; and the American Physical Society.

Professor Raymond's personal qualities were well summarized by his University associates, who described him as "a man of noble character, of dignified bearing, of courteous manner. His teaching was characterized by sound scholarship, careful preparation, clear exposition, and kindliness toward students. He was a lover of truth and a faithful teacher."[3] The senior author, who was one of his students and who knew him well in his later years, can give personal testimony to this characterization.

He was survived by the late Mrs. Isabella M. Raymond, his wife, and by two daughters, Mrs. Thomas E. Johnston and Mrs. William I. McLaughlin.

[3] Lenzen, V. F., Louderback, G. D., and Minor, R. S., 1947, William James Raymond, In Memoriam, University of California Press, 4 pp.

MOLLUSKS COLLECTED OR DESCRIBED BY W. J. RAYMOND, WITH REPOSITORIES OF TYPES OR TYPE MATERIAL INDICATED

Sphaerium raymondi J. G. Cooper, 1890 [= *Musculium*]

No record of designated types. Original material found in the Raymond collection. Now AGS no. 8746, in Calif. Acad. Sci., and several other West Coast collections.

Planorbis subcrenatus disjectus J. G. Cooper, 1890 [= *Helisoma*]

No record of designated types. Original material found in Raymond collection. Now AGS no. 8800, in Calif. Acad. Sci., and other West Coast collections.

Mytilus stearnsi Pilsbry and Raymond, 1898 [= *Brachidontes*]

Types in Acad. Nat. Sci. Philadelphia, Mus. no. 55863. Type material not found in Raymond collection.

Trivia ritteri Raymond, 1903 [= *Pusula*]

Syntypes: Calif. Acad. Sci. Paleo. Type Coll. nos. 9400. 9401, 9403, 9404; Univ. Calif. Mus. Paleo. Type nos. 33477, 33687.

Dentalium vallicolens Raymond, 1904

Syntypes: Calif. Acad. Sci. Paleo. Type Coll. nos. 9405, 9406.
Hypotypes: Calif. Acad. Sci. Paleo. Type Coll. nos. 9407, 9408, 1758.

Pleurotoma (*Genota*) *stearnsiana* Raymond, 1904 [= *Megasurcula*]

Syntypes: Calif. Acad. Sci. Paleo. Type Coll. nos. 9395, 9396, 9397, 9398, 9399.

Pleurotoma (*Antiplanes*) *catalinae* Raymond, 1904 [*Antiplanes*]

Syntypes: Calif. Acad. Sci. Paleo. Type Coll. nos. 9388, 9389, 9390, 9391, 9392, 9393, 9394.

Pleurotoma (*Genota*) *riversiana* Raymond, 1904 [= *Megasurcula*]

Type lost? Not found in the Raymond collection.

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by Professor Raymond

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1893 G. W. Lichtenthaler (Obit.)—Naut. **6**: 131.
1894 The California species of the genus *Nuttallina*—Naut. **7**: 133–134.
1895 Note on *Septifer bifurcatus* Conrad—with H. A. Pilsbry—Naut. **12**: 69–71.
1902 Dr. James G. Cooper (Obit.)—Naut. **16**: 73–75.
1903 Writings of James G. Cooper, M.D., on Conchology and Palcontology, with list of species described by him—Naut. **17**: 6–12.
1903 A new Californian *Trivia*—Naut. **17**: 85–86.
1904 A new *Dentalium* from California—Naut. **17**: 123–124.
1904 Two new species of *Pleurotoma* from California—Naut. **18**: 1–3.
1904 A new species of *Pleurotoma* from the Pleistocene of California—Naut. **18**: 14–16.
1906 The West American species of *Pleurotoma,* subgenus *Genota—Naut.* **20**: 37–39, pl. 2.

RAYMOND C. RUSH, M.D., 1875–1954

On June 23, 1954, Dr. R. C. Rush of Hudson, Ohio, suddenly passed away in his 79th year. His death removed the oldest and best-known conchologist and one of the last of the old-school naturalists in northeastern Ohio. Dr. Rush was born in Kirtland on August 8, 1875. As a boy he began to collect shells which remained one of his chief interests to the end of his life. Eventually he turned his attention to all phases of nature and was encouraged in his boyhood hobbies by two residents, Alfred Pettingill, a local jeweler and amateur naturalist, and Mathew

C. Read, who was an assistant on the staff of the original Ohio Geological Survey.

Dr. Rush graduated from the Cleveland Homeopathic Medical College at which he earned his M.D. degree in 1891. He was later given an honorary degree by Ohio State University. While he became a brilliant physician, his first interest throughout life was natural history. He was not a mere amateur collector, but a serious student of zoology. He was well versed in scientific literature and knew many of the leading naturalists, especially conchologists, either personally or through correspondence.

While conchology remained a dominant interest, he also developed proficiency in local geology, botany, entomology, and herpetology. He worked on the fossils of the Waverly group found locally and furnished many museums with specimens; he became an expert on the oaks and developed an arboretum of some 34 species and varieties of oaks.

His closest friend and field companion was Dr. Victor Sterki of the Carnegie Museum. The two frequently made their shell collecting trips together and assisted each other in their mutual interest. Dr. Rush collected especially the land and fresh water mollusks of Summit County, Ohio, and used these as a basis for exchange with collectors all over the world. He never published a major work, although he penned a number of small articles and notes for magazines and newspapers. For a period of three years he was a field biologist for the Ohio Division of Forestry.

During his later years he retired from active life and lived in a small cottage he built in the woods on the outskirts of Hudson. He presented his shell collection of some 3500 species to Kent State University. Dr. Rush also gave much of his library including a long series of THE NAUTILUS to the University. In retirement he established a small experimental nursery in which he specialized in developing his collection of oaks and in growing dwarf evergreens. One of the varieties was a dwarf, globular tamarack which he had discovered himself and propagated for the nursery trade. This gave the name of "The Tamaracks" to his nursery.

He occasionally lectured at Western Reserve Academy, the University of Akron, and Kent State University. He also fur-

nished scientific specimens to these institutions. His scientific membership included the AAAS., the Ohio Academy of Science, and the American Microscopical Society.

Naturalists such as Dr. Rush who exhibit versatility in wide-ranging interests are becoming rare. They mark the end of an era in American science.—Ralph W. Dexter, Dept. of Biology, Kent State University, Kent, Ohio.

NOTES AND NEWS

Calvin Goodrich, Curator Emeritus of mollusks at the University of Michigan Museum of Zoölogy, died suddenly in an Asheville, North Carolina, hospital, Sunday, November 7th. He was 80 last February 22nd. Widely known for his studies on pleurocerids, he will be missed by his many friends.

The Unionidae of B. H. and S. H. Wright.—This note is to call attention to a paper by C. T. Simpson (1900, Proceedings Academy Natural Sciences, Philadelphia, pp. 74–86, pl. 1–5) in which there are many figures of the types of various species of Unionidae that were originally described but never figured by the Wrights. Many of their descriptions appeared in the early volumes of The Nautilus, mainly from volumes 4 to 13.—W. J. Clench.

The S. S. Holt Collection of Liguus.—The Peabody Museum of Natural History at Yale University, New Haven, Connecticut, has just received as a gift the Sidney S. Holt collection of Florida and West Indian *Liguus*.

Mr. Holt, who on July 6, 1954, passed away in his eighty-fifth year, had been interested in the tree snails since he was a young man. He had collected in Florida and Cuba nearly every year for more than fifty years. This collection consists of some 1000 lots, all in plastic vials, and all carefully documented. Included are many varieties that have been extinct for years, and representative lots from numerous localities that have now become thriving towns or resorts.—Percy A. Morris.

Chair of Malacology created by the Academy of Natural Sciences of Philadelphia in honor of Henry A. Pilsbry.—In recognition of the work of the Academy's Henry A. Pilsbry, a member of the scientific staff for more than 66 years, and

ranked as one of the world's authorities on mollusks, the Academy announces the Henry A. Pilsbry Chair of Malacology with R. Tucker Abbott as the incumbent.

The endowment for this chair is being provided in part by Mr. Alfred J. Ostheimer, 3rd, Philadelphia insurance man and President of the Natural Science Foundation, together with Miss Anne Harbison and other friends of the Academy. The endowment will be known as the Henry A. Pilsbry Fund.

Dr. Pilsbry was 92 on December 7. He is now Curator of Mollusks and other Invertebrates.

Mr. Abbott comes to the Academy from the United States National Museum, Washington, where he has been Associate Curator of Mollusks.—H. Radclyffe Roberts, Director, A.N.S.

Nenia in the Argentine.—A new southern record for this genus has recently been made known: *Nenia argentina* Hylton Scott (Neotropica 1: 1–4, 1954). It is from La Capillus, Prov. Jujuy, northwestern Argentina, a place far to the south of any previous record of this Andean genus of *Clausiliidae*.

Preparation of Nudibranchiata.—While working in southeast Alaska during 1946 some experiments were made in an endeavor to kill and preserve some nudibranch mollusks in a fully expanded condition for Dr. F. M. MacFarland. It is well known that these animals are prone to shed appendages and contract badly when disturbed by the usual methods of preparation such as anesthetizing.

One method which promised success could not be carried to conclusion through lack of facilities and it was not until July 1954 that the subject could be taken up again. The Arctic Research Laboratory at Point Barrow offered ideal conditions in this respect and it was found that the local nudibranchs which were obtained incidentally in connection with marine geological work could be killed and preserved fully expanded and with all appendages intact. The method consisted of putting the specimens in a vessel of normal sea water sufficient only to permit them to crawl about quietly. The vessel was then transferred to the freezing compartment of a refrigerator or a deep freeze and the water was frozen solid. All specimens which have been tried have not shown the slightest tendency to contract or disengage parts. Upon removal from the freezer I have added alcohol at times and formaldehyde (4%) at other

times. In either case, as melting proceeded, nothing happened to the specimens; they were killed in the same attitude in which they were frozen.

In view of the simplicity of the process it is interesting to speculate upon the possibility of using it for gastropods and such marine animals as sea anemones which are prone to contract upon the least provocation.—G. D. Hanna.

Labyrinthus Beck vs. Lampadion Röding.—In the course of some recent studies on the American Camaenidae I had occasion to investigate the nomenclature of the various generic groups. During this bibliographic work an item of some interest occurred. This was the validity of *Lampadion* Röding, 1798. The International Commission on Zoological Nomenclature recognized the sales catalog, Museum Boltenianum, as nomenclatorially available under Opinion 96. It was assumed from this, by subsequent students, that *Lampadion* Röding replaced *Labyrinthus* Beck, 1837, a commonly recognized generic term among the American camaenids.

Gray, 1847, selected as type for *Lampadion* (probably without ever seeing a copy of Museum Boltenianum), *Helix otis* Solander, 1786. This species, as it was not included in Museum Boltenianum under that name, cannot be accepted as type of *Lampadion* (Art. 30, II, a).

Helix otis has priority over *Labyrinthus labyrinthus* "Chemnitz" Deshayes, 1838. This is a species long recognized, and no doubt it is what Gray had in mind when selecting *H. otis* as type of *Lampadion,* as he included *Labyrinthus* in his synonymy of *Lampadion.* Röding, in Museum Boltenianum, did include a species, *Lampadion labyrintha.* However, as a reference for this species, Röding referred to Favanne (pre-Linnaean), pl. 63, fig. 2. On this plate there are seven figures labelled "2", separable from each other by a letter prefix (viz., A, B, D, F, G, I and L). None of these is *L. labyrinthus* "Chemnitz" Deshayes. However, this latter species is represented on the plate by figure "F 11." Therefore, I here select as type for *Lampadion* Röding, 1798, Museum Boltenianum, pp. 77–78, his *Lampadion labyrintha,* choosing figure F 2, plate 63, of Favanne as type. This figure is of some "Helix." I do not recognize the species. It would appear that this action effec-

tively buries the generic term *Lampadion* as far as current nomenclature is concerned.—Charles B. Wurtz.

Melania cancellata Say—This species[1] of Say was based upon a single specimen "collected" by Capt. Leconte in the St. John's River, Florida. It was never figured. The short description seems to apply to *Goniobasis floridensis* Reeve, a widely distributed species in central and northern Florida, but is usually rejected by most authors as not quite fitting the characters possessed by this common Florida species.

Apparently this species is not a member of our North American fauna but one from India, along with *Paludina multilineata* Say and *Ampullaria rotundata* Say. Both of these species also were stated to have come from the St. John's River, Florida and to have been "collected" by Capt. Leconte. They are, however, now known to be species from India.[2] *Melania cancellata* Say can be added to these two; it is an absolute synonym of *Melanoides tuberculata* Müll., a very common and exceedingly widely distributed species in Africa and southern Asia.

In some manner, a small collection from India had become mixed with Capt. Leconte's other material from the St. John's River and subsequently were considered as new by Say. This was a easy error for Say to make, certainly at the time they were described, because of the similarity of the species in both of these remote localities.—William J. Clench.

PUBLICATIONS RECEIVED

Distribution and variation of the Hawaiian tree snail *Achatinella bulimoides* Swainson on the leeward and northern slopes of the Koolau range, Oahu. By d'Alté A. Welch. Proc. Acad. Nat. Sci. Philadelphia, vol. 106, pp. 63–107, pls. 1 and 2. 1954.—This is the third of Dr. Welch's interesting studies on *Achatinella* in the mountains of its only island. The other two (Bishop Mus. Bull. 152, pp. 1–164; and Smithson. Misc. Coll., vol. 103, no. 1, pp. 1–236) discussed, in equal exactness of detail, the distribution and variation of *A. mustelina* and *A. apexfulva*.

[1] *Melania cancellata* Say 1829, New Harmony Disseminator **2**, p. 260 (St. John's River, Florida).

[2] Pilsbry, H. A. 1953, Nautilus **67**, p. 58.

In the present contribution, out of 10 subspecies recognized, 6 were new. As a general trend, similar to that found in *A. mustelina,* mean height of the shells varied inversely with elevation and relative humidity. But, the very highest localities all had larger shells than those below them, which may indicate less rainfall at the summits of the Koolau ridge. The same color patterns, especially the white ones, reoccurred in different areas, but the brown showed a wider range of patterns than did the white. Colors changed at different elevations and also horizontally in each altitude zone. Ecologic factors, as well as the effects of isolation, seemed to influence the divergence of subspecies. Although not so big as our *Liguus,* the colors and high polish in *Achatinella* make it far more beautiful.—H. B. B.

Inland Mollusca of northern Mexico. II. Urocoptidae, Pupillidae, Strobilopsidae, Valloniidae and Cionellidae. By Henry A. Pilsbry. Proc. Acad. Nat. Sci. Philadelphia, vol. 105, pp. 133–167, figs. 1–3, pls. 3–10. 1953.—*Coelocentrum* (*Ptychodonta*) *endolophus, Propilsbrya potosiana, P. infernilla, Holospira* (*Prionoloplax,* n. subg.) *odontoplax, H. temeroso, H. catorceana, H. maxwelli, H. pedroana laevissima, H. stenopylis, H. cyclostoma, H.* (*Bostrichocentrum*) *anomala, H.* (*Allocoryphe*) *remondii* (Gabb), subspp. *laevior, yaquensis* and *forticostata,* H. (A.) *dentaxis,* with subspp. *lamellaxis, striatella* and *potamia, Coelostemma saltillensis, C. chilpancingensis, C. lissocentrum, C. hazelae, C.* (*Apertaxis,* n. subg.) *amplaxis, Hendersoniella palmeri simplex, Gastrocopta bibasidens* and *Chaenaxis sonorensis* are new taxonomic entities. All are figured, with remarkably clear photographs of their peculiar columellar armatures.—H. B. B.

The Idaho-Montana slug *Magnipelta* (Arionidae). By Henry A. Pilsbry and Royal Bruce Brunson. Notulae Naturae, no. 262, pp. 1–6, 10 figs. 1954.—More complete details are given for this remarkable slug, from a new locality near Missoula, Montana. From fig. 1, its locomotion appears to be less "arhyth mic" (without sole waves) than in some other Arionidae.—H. B. B.

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HETERURETHROUS AND AULACOPOD

By H. BURRINGTON BAKER

The land snails or geophiles,[1] as restricted, include at least 4 suborders: (1) Orthurethra (pupilloids, etc.).[2] (2) Mesurethra (cerionoids). (3) Heterurethra, including Succineidae, Aillyidae and (?) Athoracophoridae. (4) Sigmurethra, including Achatinoidea, Bulimuloidea, Arionoidea, Limacoidea, etc.

In the Orthurethra, the kidney and/or direct ureter are long, so that the urinary opening is quite near the pneumostome even when a short, primary or adrenal, reflected ureter is represented by an open groove (LMNA2, p. 852) or when it is closed, as apparently in *Pupisoma* (p. 1007) and also in Planorbidae (F. C. Baker) and "Bulinidae" (order Limnophila).

In the Cerionoidea, the ureter is represented mainly by the lateral opening of the relatively short kidney, as in Dorcasiidae (Pilsbry, 1905, f. 7), Corillidae (f. 3), Strophocheilidae (Scott, 1939) and Cerionidae (LMNA2, p. 160).

In the Heterurethra, *Succinea* (LMNA2, p. 771) and *Oxyloma* (Quick) have an aulacopod foot and a heterurethrous pallial complex. The lung is short, as it is in superficially similar Sigmurethra (1940n & 1942n). The aulacopod foot has 2 pedal or peripodial grooves, as in Zonitidae (LMNA2, p. 232, f. A) or Helicarionidae (1938z & 1940z). These extend around the foot[3] just above the sole. The heterurethrous lung has a

[1] Order Geophila Férussac, 1812. This return to the earliest name is because it is not preoccupied, has no different modern connotation, and is short.

[2] Superfamily Pupilloidea. Outside of mollusks, in which Thiele used the ending "— acea" for his "stirpes," this suffix (-oidea) is becoming standard in zoölogy. Cf. G. G. Simpson, 1945, Bull. Amer. Mus. Nat. Hist. 85, p. 25.

[3] Neither of them is above the foot, i.e., "suprapedal" (H. B. B., 1925).

transverse kidney, which extends from the pericardium to the rectum; it lies at right angles to the heart axis along the apical lung wall. The primary limb of the ureter begins at or very near the pericardium and runs transversely across to the rectum. The secondary ureter along the rectum continues the short distance to the urinary chamber of the pneumostome; i.e., it is complete.

In some more slug-like Heterurethra, such as *Omalonyx* (1926m, f. 79) and *Aillya* (Odhner, 1927), which (when preserved) apparently had no or only one pedal groove, the heart axis of the lung is rotated, so that the kidney becomes longitudinal in respect to the body. Similar rotation occurs in many unrelated slugs, such as geophile limacoids and Chlamydephoridae, and gymnophile [4] Veronicellidae (*Phyllocaulis*), and also in patelliforms, like limnophile Lancidae (1925L) and Ancylidae, and thalassophile *Siphonaria* (Hubendick). It is carried farther in *Veronicella* (1925p) and results in complete reversal in Onchidiidae (Gymnophila) and Testacellidae (Geophila). Incidentally, the lung of the bulimulid slug *Gaeotis* (1940n, p. 62) is unlike that of *Aillya,* although somewhat similarly rotated.

The athoracophorid slugs combine somewhat less rotation with a long, folded ureter and a reduced lung, both of which also occur in patelliform Ancylidae (Limnophila) and in veronicellid slugs (Gymnophila). They also have lung lobes, which are intriguingly similar to the lung venation of *Omalonyx.* In *Athoracophorus*, the anal, urinary and air pores are separated, but some separation of these is also a peculiarity of *Omalonyx* (1926m, f. 80).

Now please come back to the main theme, which began with *Succinea.*

In some Sigmurethra with a considerably longer lung, a similarly transverse or heterurethrous kidney again is associated with an aulacopod foot, as in primitive Achatinidae like *Opeas* (LMNA2, p. 182) and *Neosubulina* (1927m, f. 9). Fur-

[4] Order Gymnophila: Rathousiidae, Veronicellidae and Onchidiidae. The 1st and 2nd are Soleolifera (1890), the 2nd and 3rd Teletremata (1898), and only the 3rd introverts its eye tentacles, "die gewöhnlich wie bei den Stylommatophoren eingestülpt werden können" (Plate, 1893); but they are all naked slugs.

thermore, an aulacopod foot and a less transverse kidney, which still extends from the pericardium to the rectum, is found in other primitive Achatinidae, such as *Ferussacia* and *Cecilioides* (Watson, 1928), *Ochrodermella* (1945n, p. 87), *Pseudoglessula* (Pilsbry, 1919, f. 52; Odhner, 1932) and probably *Connollya* (Odhner). Somewhat the same combination occurs again in primitive Arionoidea: *Trachycystis* (Watson, 1934), *Helicodiscus* (LMNA2, p. 628), *Punctum* (p. 642), *Radiodiscus* (p. 655, & 1927p, f. 30), *Chanomphalus* (f. 52) and *Rotadiscus* (f. 17–20). Associated with a less aulacopod foot, similar kidneys also appear in other Achatinoidea: Streptaxidae (Pilsbry, 1907, & 1919, f. 68; Odhner, 1932, textf. 1, 2 & 8). Austroselenitinae (1941n2). Subulininae (Odhner, textf. 13, 19 & 24; LMNA2, p. 176; & 1927m, f. 2). Spiraxidae (1939n). And even in bulimuloid Urocoptidae (1927m, f. 28 & 30).

In many of these achatinoids and arionoids, and in the bulimuloids, the pericardial extension of the kidney is longer than the rectal one, and thus approaches the usual sigmurethrous condition. In very small species of arionoids, like *Punctum,* and of achatinoids, like *Spiraxis* and *Micromena* (1939n, both f. 3), the kidney becomes U-shaped. In other achatinoids, such as *Ferussacia, Cecilioides* and *Ochrodermella,* the rectal limb is considerably longer than the pericardial one; this perhaps goes the farthest in the arionoid *Rotadiscus.* As stated in 1927, this still looks "like an unproductive experiment in the opposite direction from the sigmurethrous" arrangement.

All this evidence points to but one conclusion: the ancestors of the Sigmurethra probably had an aulacopod foot and a heterurethrous lung, which perhaps was rather short. Both have been modified secondarily, in otherwise divergent groups.

Apparently, the aulacopod foot is retained in all arionoids and limacoids (including Testacellidae) except *Poecilozonites.* But it also is found in one genus of Polygyrellinae, *Glyptostoma* (LMNA2, p. 506) especially in its subgenus *Megomphix* (p. 508) [5] which also has a tripartite sole and a caudal foss or pit.

[5] This has been checked recently and its secondary ureter is open as in *Glyptostoma* (LMNA1, p. 567). As used here, the Polygyrellinae, with Megomphicinae as its prior synonym, include 2 small genera: *Polygyrella* (pp. 555–566) and *Glyptostoma.* Attention is called to another "accessory sac of the vagina" in the arionoid *Radioconus* (1927p, f. 25 & 26) and in the limacoid *Ogaridiscus* (LMNA2, p. 416, f. 3 & 4).

From the above brief summary, one might get the idea that these hypotheses were founded on only two characters. This is only illusory. In the preparation of a glossary of technical terms, other structures have been studied, and most of them fit fairly well into this general picture. Of course, adaptive convergences, such as reduction of the shell (patelliforms and slugs) and aculeate radular teeth, must be considered relatively insignificant.

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A RECTIFICATION OF PECTEN NOMENCLATURE

By GILBERT GRAU

In 1925 Dr. W. H. Dall described a new species of eastern American pelecypod, *Pecten* (*Euvola*) *tereinus* [Nautilus, 38(4), p. 115]. Last year the writer acquired a copy of Vol. 13, Extrait des Mémoires de la Société Zoologique de France (1900), and upon finding therein Dautzenberg's description and figures of a new species, *Pecten chazaliei,* concluded that it was almost certainly identical with *P. tereinus.*

A study was made of material in the author's collection, consisting of 8 specimens of *P. tereinus* ranging from 12 to 26 mm. in altitude, 21 single valves from 4 to 25 mm. and 5 fragments, including a broken left valve which must have been about 35 mm. high when living. The following localities were represented: Palm Beach, southeast Florida and Fort Walton, northwest Florida; Havana, Cuba; Tobago, British West Indies; Tortuga Island, Venezuela; Cape La Vela, Colombia; Victoria Channel, British Honduras; northeast Mexico (50 miles southeast of Port Isabel, Texas). All the above material fitted the description and figures of *P. chazaliei.*

An inquiry to the Museum d'Histoire Naturelle in Paris regarding Dautzenberg's holotype elicited the information that it was deposited in the Institut Royal des Sciences Naturelles in Brussels. Dr. W. Adam, of that institution, kindly consented to comparing a series of specimens of *P. tereinus* with the holotype of *P. chazaliei.* After studying the shells he concluded "As to *Pecten chazaliei,* your material agrees perfectly with this species."

As the result of the foregoing, it can be stated with assurance that *Pecten* (*Euvola*) *chazaliei* is the valid name for this species, with *P. tereinus* Dall a synonym.

Dautzenberg's species was first collected during a cruise of the yacht Chazalie in 1896, the type locality being station 26 (Jan. 20), Los Testigos Islands, Venezuela in 80 meters (about 45 fathoms). Dall's holotype was dredged off Key West, Florida at station 3318 of the United States Fish Commission in 45 fathoms.

Regarding the geographical and bathymetrical range of this

species, Dall gave "Miami, Florida to the Bahamas and south to Cape Rocque, Brazil"; C. W. Johnson, in his List of the Marine Mollusca of the Atlantic Coast from Labrador to Texas (Proc. Boston Soc. of Nat. Hist., vol. 40, no. 1, p. 24, 1934) gave "Miami to Key West, Fla., 45 fath."; R. Tucker Abbott, in his book American Seashells (1954), gave "southern Florida and the Gulf of Mexico in 10 to 40 fathoms." The author's collection contains two specimens taken in 75 fathoms off Fort Walton, northwest Florida, and the species has probably been taken at even greater depths. On the basis of information available at present we can regard the geographical range of *P. chazaliei* as southern Florida, southward through the West Indies to Cape Rocque, Brazil, the Caribbean Sea and the Gulf of Mexico; the bathymetrical range as from 10 to 75 fathoms.

Pecten chazaliei is still a rather rare species. It differs from *P. ziczac* and *P. raveneli* in the following respects: both valves much thinner and very fragile, right (lower) valve much less convex, left (upper) valve having interspaces much wider than the ribs, internal grooving from umbonal area to margin and paler and more delicate coloring. From the species it most resembles, *P. turtoni* Smith (Saint Helena Island, southeastern Atlantic), it differs in having a thinner shell, more numerous and rounded (rather than angular) ribs, less convex right valve and paler color.

It is interesting to note that in their descriptions of this species both Dautzenberg and Dall mentioned internal grooving rather than internal ribbing. Dall had previously discussed the possibility that *Amusium* may have evolved from *Pecten* by way of *Euvola* (Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 693, 1898), based on his conclusion that both *Amusium* and *Euvola* possessed internal ribs conforming to the external. The author regards his premise as untenable for two reasons. First, *Amusium* seldom shows evidence of external ribbing; when present it is very weak and can be seen to have no particular relationship to the internal ribbing. Second, *Euvola* does not possess independent internal ribs, only grooves which conform to and are a direct result of the external ribs. Whether Dall reversed his opinion on this matter between 1898 and 1925 and deliberately referred to internal grooves in de-

scribing *P. tereinus,* or whether he retained the opinion and only inadvertently used the term grooves is something we will never know.

AN ANALYSIS OF THE ARCTIC MARINE PELECYPOD FAUNA

By DAVID NICOL

U. S. National Museum

The main component of the arctic pelecypod fauna appears to be primitive forms which have a free or active mode of life. The second most important component of the fauna includes the more specialized burrowers, but, in general, they do not appear to be as widespread in arctic waters.

Most of the Point Barrow, Alaska, pelecypods collected and identified by Mrs. G. E. MacGinitie are in the collections of the U. S. National Museum. Examination of these arctic pelecypods reveals that they represent more than the usual number of primitive genera and families.

In what way are they primitive? Generally in this discussion, the term is used in the sense of ancient. Even arctic groups that are not primitive in the morphologic sense (e.g., the eulamellibranch heterodonts) are ancient, as has become more and more apparent with our increasing knowledge of Paleozoic pelecypods.

To analyze the arctic pelecypod fauna, mainly from the standpoint of evolution and ecology at the generic and familial levels, I have drawn a great amount of information from two papers by Soot-Ryen and have used these works to supplement the study of MacGinitie's partial collection at the U. S. National Museum. Although there are many other lists of arctic pelecypods, most of them nearly duplicate Soot-Ryen's works. By way of comparison with the arctic pelecypod fauna, I have also reviewed the pelecypod fauna of the southwest coast of Florida as described by Perry.

The most conspicuous, and in some cases well known, characteristics of the arctic pelecypods are as follows:

1. There are few families, genera, and species represented, but these few are often exceedingly abundant as to individuals, and many of the common species are variable. This is true of many arctic representatives of other phyla, classes, and orders.

2. Arctic pelecypods are generally thin-shelled and usually have a periostracum or an exterior layer of conchyolin; the calcareous shell is often of a chalky texture.

3. Few arctic pelecypods are colored (although a species of *Chlamys* from Point Barrow has some lavender); the arctic pelecypods lack the beautiful color patterns of browns, reds, greens, purples, etc., that are common among warm-water marine bivalves. No arctic pelecypods are spinose; ornamentation is not common and, where present, is subdued.

TABLE 1. Pelecypods collected and identified by Mrs. G. E. MacGinitie from Point Barrow, Alaska

	Species	Sta.[1]	Ind.[2]	Time of appearance
Nuculidae				Devonian? Pennsylvanian
Nucula	1	12	105	
Nuculanidae				Silurian? Pennsylvanian
Nuculana	1	3	10	
Yoldia	3	26	91	
Mytilidae				Ordovician? Mississippian
Musculus	4	38	223	
Mytilus	1	2	2	
Pectinidae				Late Permian or Early Triassic
Chlamys	1	6	15	
Astartidae				Pennsylvanian
Astarte	2	18	83	
Carditidae				Triassic
Cardita	2	15	54	
Cardiidae				Late Triassic
Serripes	1	11	25	
Clinocardium	1	2	3	
Veneridae				Cretaceous
Liocyma	1	8	13	
Tellinidae				Cretaceous
Macoma	4	36	345	
Hiatellidae				Cretaceous
Hiatella	1	25	362	
Panomya	2	3	5	
Myacidae				Cenozoic
Mya	2	22	70	
Lyonsiidae				Cenozoic
Lyonsia	1	1	2	

[1] Stations.
[2] Individuals.

4. Unlike arctic representatives of some other phyla and classes of animals, the arctic pelecypods do not have a single species that would be considered large in size. The largest shell in the Point Barrow collection is a species of *Chlamys,* 80 mm. high and 72 mm. long. Some of the most abundant arctic pelecypod genera belong to groups which are consistently small: the nuculids, nuculanids, and astartids. Some of the astartids from Point Barrow are large for that family, but representatives of the Astartidae never attain a large size in comparison to many other pelecypods.

Some of the morphologic characteristics of arctic pelecypods are also typical of deep-water pelecypods from non-arctic regions. Moreover, some genera are common to both arctic and deep non-arctic water.

TABLE 2. Arctic pelecypods listed by Soot-Ryen (1939, p. 20). C—Circumarctic forms. P—Pacific forms

	Species	Time of appearance
Nuculidae (C, P)		Devonian? Pennsylvanian
Nucula (C, P)	1C, 1P	
Nuculanidae (P)		Silurian? Pennsylvanian
Nuculana (P)	1P	
Portlandia (P)	1P	
Mytilidae (C, P)		Ordovician? Mississippian
Musculus (C, P)	3C, 3P	
Crenella (P)	1P	
Astartidae (C, P)		Pennsylvanian
Astarte (C, P)	2C, 4P	
Thyasiridae (P)		Cretaceous
Thyasira (P)	1P	
Cardiidae (C, P)		Late Triassic
Serripes (C, P)	1C, 1P	
"*Cardium*" (P)	1P	
Veneridae (P)		Cretaceous
Liocyma (P)	1P	
Tellinidae (C, P)		Cretaceous
Macoma (C, P)	1C, 1P	
Hiatellidae (P)		Cretaceous
Hiatella (P)	1P	
Myacidae (P)		Cenozoic
Mya (P)	1P	
Pandoridae (P)		Cenozoic
Pandora (P)	1P	
Cuspidariidae (P)		Jurassic
Cuspidaria (P)	1P	

Comparative Analysis

Table 1 is a list of most of the pelecypods that MacGinitie collected at Point Barrow, Alaska. Table 2 is a compilation of arctic pelecypods from a publication by Soot-Ryen (1939, p. 20). To compare with these two lists of arctic pelecypods table 3 is a presentation by family of the pelecypod fauna described by Perry (1940) from the southwest coast of Florida.

Table 3. A compilation of the pelecypod families listed by Perry from southwest Florida

Family	No. of genera	No. of species	Time of appearance
Solemyidae	1	1	Mississippian
Nuculidae	1	1	Devonian? Pennsylvanian
Nuculanidae	1	1	Silurian? Pennsylvanian
Arcidae[1]	5	9	Jurassic
Glycymeridae	1	1	Cretaceous
Anomiidae	2	2	Jurassic
Mytilidae	8	13	Ordovician? Mississippian
Pinnidae	1	2	Devonian? Mississippian
Pteriidae	2	3	Triassic
Ostreidae	1	4	Triassic
Spondylidae	2	2	Triassic
Pectinidae	4	7	Late Permian or Early Triassic
Limidae	1	1	Triassic
Periplomatidae	1	1	Cenozoic
Pandoridae	2	3	Cenozoic
Lyonsiidae	1	2	Cenozoic
Cyrenidae	1	2	Jurassic
Crassatellidae	1	1	Cretaceous
Carditidae	3	3	Triassic
Chamidae	3	4	Cenozoic
Diplodontidae	2	2	Cretaceous
Lucinidae	6	8	Jurassic
Leptonidae	1	1	Cenozoic
Cardiidae	4	6	Late Triassic
Veneridae	10	20	Cretaceous
Petricolidae	2	2	Cretaceous
Trapeziidae	1	1	Jurassic
Tellinidae	8	20	Cretaceous
Semelidae	3	8	Cenozoic
Donacidae	1	1	Cretaceous
Sanguinolariidae	1	2	Cretaceous
Solenidae	1	1	Cretaceous
Mactridae	5	5	Cretaceous
Corbulidae	1	5	Triassic
Hiatellidae	1	1	Cretaceous
Gastrochaenidae	1	2	Jurassic
Pholadidae	3	5	Jurassic
Cuspidariidae	1	1	Jurassic

[1] Sensu lato.

Perry's work has been used as a standard of comparison because it is confined to one relatively small region and concerns a warm-water fauna that is not ecologically specialized.

According to Soot-Ryen's 1939 list of pelecypods (p. 20) there are but five families, each with one genus, which are represented throughout the arctic: Nuculidae, *Nucula;* Mytilidae, *Musculus;* Astartidae, *Astarte;* Cardiidae, *Serripes;* and Tellinidae, *Macoma.* However, in an earlier list (1932, p. 20) Soot-Ryen also includes one nuculanid, *Portlandia,* among the circumarctic forms, and I believe this family should be included in a discussion of the true circumarctic groups. This small list probably will be increased with further knowledge of arctic pelecypods.

It may be well to analyze these six families in some detail. All are represented in MacGinitie's collection by more than 25 specimens each. The Nuculidae are a primitive group from the standpoint of both time and morphology. Representatives of the family appear at least as early as the Pennsylvanian and possibly as early as the Devonian. The Nuculanidae, like the nuculids, are also primitive in structure and age, and typical members of the family appear at least as early as Pennsylvanian time, possibly earlier. Another family that is primitive in the sense of time and is well represented in the arctic today is the Mytilidae, which had its inception in the Mississippian Period. A common family of arctic and boreal pelecypods is the Astartidae, probably the most ancient of the living eulamellibranch heterodonts, which had representatives as early as Pennsylvanian time. The Astartidae could be considered a relict family because it is almost totally confined to north temperate and arctic waters. (The number of relict genera among the arctic pelecypods may be quite large, but this subject has never been carefully investigated.) The cardiids are also one of the more ancient heterodont stocks, first appearing in the late Triassic. By far the most modern group of the six and also the largest family from the standpoint of living species, is the Tellinidae, which is represented by the genus *Macoma.* The tellinids first appeared in the Cretaceous. Thus apparently, four of the six families—the Nuculidae, Nuculanidae, Mytilidae, and Astartidae—are definitely primitive, having appeared at

least as early as Pennsylvanian time. Furthermore, the cardiids cannot be considered a young family, and even the tellinids range back to the Cretaceous.

It is interesting to note here that arctic pelecypods generally are characterized by a dearth of attached forms, and I know of none which like *Ostrea* and *Chama,* attaches by its shell to the substratum. Of the six genera of circumarctic pelecypods, *Nucula, Portlandia, Serripes,* and *Astarte* are all free or active forms which may burrow shallowly but also move freely about a muddy or sandy bottom. *Macoma* is a true burrowing form that usually remains in one place in the fine sand or muddy bottom. *Musculus,* on the other hand, is attached by a byssus to some hard object, usually a crevice in rocks. (Most ecological data are taken from Keen and Frizzell, 1939.)

It is necessary, however, to consider some other groups which get into arctic waters, although they may not be found all over the arctic region. In MacGinitie's Point Barrow collection at the U. S. National Museum are 101 specimens of Nuculanidae, not all which are circumarctic species; there are three species of *Yoldia* and one species of *Nuculana.* Soot-Ryen (1939, p. 20) records two genera of nuculanids, *Nuculana* and *Portlandia,* from a portion of the arctic region. Most species of the Nuculanidae are confined to cold and/or deep water. As is interesting, the nuculids and nuculanids are more poorly represented in southwest Florida than in the arctic. Besides *Musculus,* two other genera of mytilids have been found in arctic waters, *Mytilus* and *Crenella,* but their occurrence appears to be sporadic. *Mytilus* is always attached by a byssus to some solid object, but *Crenella* apparently moves about in sandy or muddy bottoms. The genus *Chlamys* is represented by six specimens in the collection from Point Barrow. Soot-Ryen reports the genus from a part of the arctic in 1932 but does not mention *Chlamys* in his 1939 paper. The Pectinidae are a primitive group, appearing first in either the late Permian or the early Triassic. *Chlamys* is either free-swimming or attached by a byssus. In the Point Barrow material are two species of *Cardita* represented by 54 specimens from 15 stations; strangely Soot-Ryen does not mention the family in his 1939 compilation—this is probably an oversight. However, in his earlier and more ex-

tensive list of arctic pelecypods (1932, pp. 20–21), he does include species of carditids as occurring in the arctic. The carditids are free or active heterodonts which first appeared in the Triassic Period. *Clinocardium* seems to occur sporadically in the arctic region; only three specimens were collected at Point Barrow. Soot-Ryen reports *Thyasira* as occurring in a part of the Arctic Ocean, but MacGinitie does not have it in the Point Barrow collection at the U. S. National Museum. *Liocyma,* a venerid, is reported by Soot-Ryen, and the Point Barrow collection includes 13 specimens of one species. This is certainly a poor representation for one of the largest, if not the largest, families of marine pelecypods from the standpoint of number of described living species. There are 20 venerid species from southwest Florida. In the Point Barrow collection, the Hiatellidae are represented by two genera, *Hiatella* and *Panomya,* and over 300 specimens, and the family has also been reported by Soot-Ryen from arctic waters. The members of the Hiatellidae are generally burrowers. The family first made its appearance in the Cretaceous Period. MacGinitie lists two species of *Mya* (70 specimens) from Point Barrow, and Soot-Ryen also records it from a part of the arctic region. The myacids are confined to the Cenozoic; they burrow in sand and mud. There are two specimens of *Lyonsia* from Point Barrow, but Soot-Ryen does not list the genus from arctic waters. On the other hand, Soot-Ryen reports *Pandora* and *Cuspidaria* from arctic waters, but these two genera were apparently not collected at Point Barrow. *Pandora* is a nestling form. *Cuspidaria* is generally found in deep water.

To summarize these data, I can say that the main component of the arctic pelecypod fauna is made up of primitive, free or active pelecypods like the nuculids, nuculanids, astartids, and cardiids. The second most important component of the arctic fauna is the more recent and more specialized burrowers or borers—*Macoma, Hiatella, Mya;* these, with the exception of *Macoma,* are not as widespread in arctic waters as the primitive, free or active forms. Some genera are deep water forms, such as *Cuspidaria,* which straggle into the arctic region; some of the nuculids, nuculanids, and carditids are found at 800 to 1,500 fathoms in non-arctic regions and are also found in arctic

waters. Nestlers like *Pandora* and *Lyonsia* are found in arctic waters, but their occurrence is sporadic.

Perhaps the most interesting thing about the arctic pelecypod fauna is not what is present, but what is either not present or poorly represented. The venerids are scarce in the arctic—one species is found only sporadically. This large pelecypod family is a dominant group in most seas today. Another large family, the Tellinidae, is represented by only one genus with a few species, although in the southwest part of Florida it has 8 genera or subgenera and 20 species; on the basis of size, number of living species, and genera, it should also be better represented. The large family Lucinidae is wholly lacking in the arctic region. The Pectinidae, another large family, is not well represented; and the prionodonts, including the Limopsidae, Glycymeridae, Arcidae, Anadaridae, and Noetiidae, are either wholly lacking or nearly so. Both the Pectinidae and the Prionodonta are represented by a large number of byssate forms, but the mytilids make up the bulk of the byssal attached forms in the arctic. The mactrids and corbulids are not found in arctic waters, and this list could be extended to include many other medium-sized pelecypod families.

Undoubtedly the lack of a wide variety of habitats in arctic waters, as compared to the tropics, limits the number of genera and families represented and also inhibits certain adaptational types of pelecypods from entering arctic waters.

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THE TITIAN R. PEALE SHELL COLLECTION

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When Thomas Say, America's first conchologist, set off in the autumn of 1817 on his first major expedition, he took with him the youngest member of the newly established Academy of Natural Sciences of Philadelphia. Seventeen-year-old Titian Ramsay Peale was already well-versed in museums, natural history and draughtsmanship. His father, Charles Willson Peale, was the founder and owner of the Philadelphia Museum (known more familiarly as "Peale's Museum") and was at that time America's foremost portrait painter. The material collected on this trip was deposited mainly in the Academy cabinets, although some specimens went to the Philadelphia Museum, and some shells, as we now suspect, into Titian's private collection (see *Cerithium dislocatum* below).

Two years later, Say and Peale were once more collecting and sketching in unknown territory, this time as members of Major Stephen H. Long's expedition (1819–20) which explored the country between the Mississippi and the Rocky Mountains. Peale, incidentally, was in the small group that first reached the top of Pike's Peak. The extensive collections were largely deposited by Major Long in the Philadelphia Museum. In 1824, the ornithologist, Bonaparte, sent Peale to collect in Florida. Seven years later Titian accompanied the Dr. M. Burrough's expedition to the Magdalena River in Colombia, South America. The land and freshwater mollusks were described by Isaac Lea, and some of the figured types were retained in Titian's private collection.

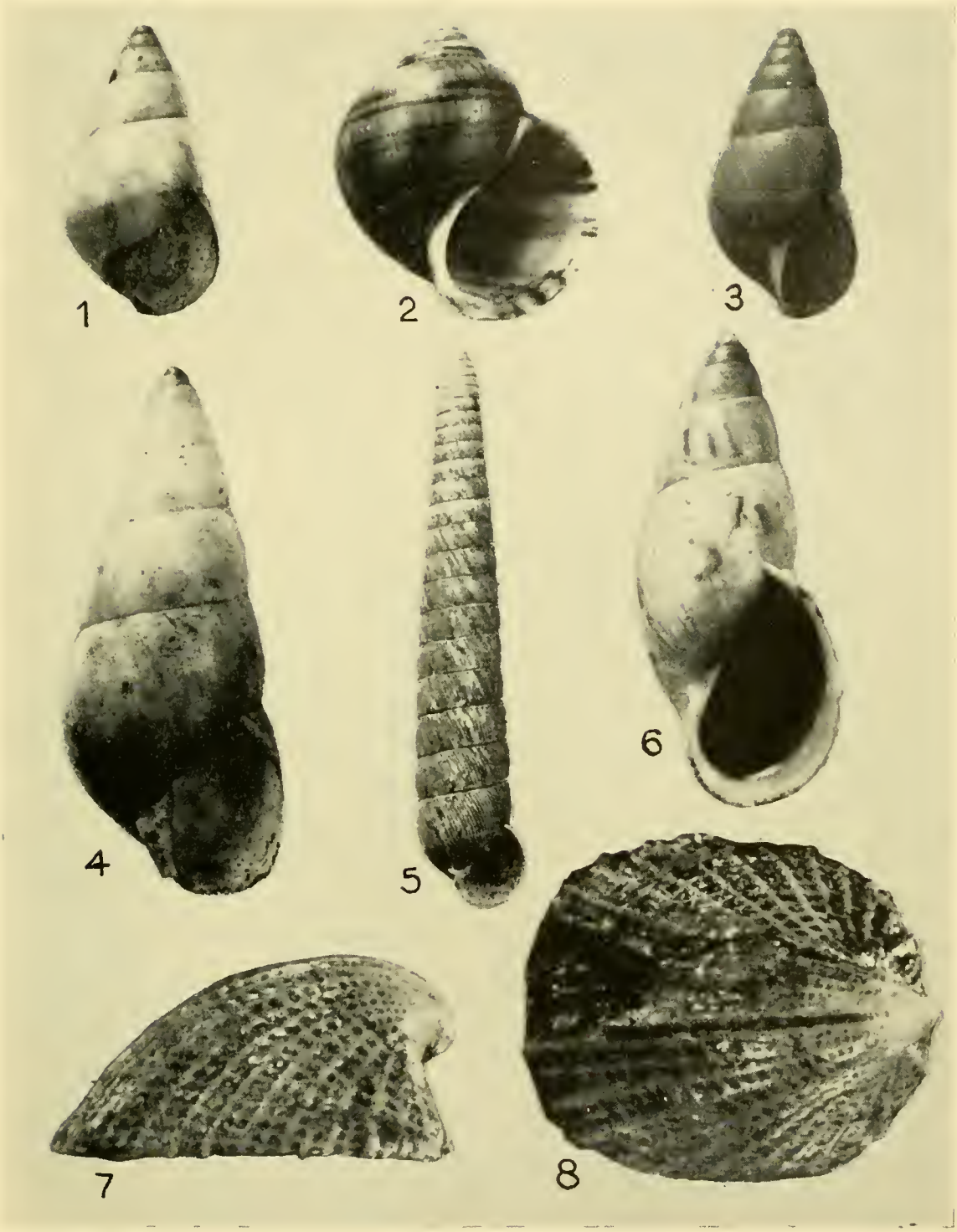
Peale was one of the three naturalists on Wilkes' United States Exploring Expedition (August 1838 to June 1842). Couthouy was the official conchologist, and Peale's acquisition of some mollusk specimens was incidental to his duties as artist and mammalogist. The great majority of the U. S. Exploring Expedition marine mollusks in the U. S. National Museum and elsewhere are without locality data, and as is interesting to know, Peale's private collection contained a few lots with ac-

curate data: Clermont de Tonnere (Minerva) Id.; Disappointment Id. (*Cypraecassis rufa* Linné); Carlshoff Id.; Dog. Id. or Henuake (*Tridacna maxima* Röding); Raratea; (all Taumotu Ids., 1839); Tutuila Id., Samoa (*Harpa major* Röding, *Strombus gibberulus* Linné, *Cypraea mauritiana* and *Ovula ovum* Linné [the latter worn by natives and possibly brought over from Upolu or Fiji]; Upolu Id., British Samoa (*Lambis violacea* Swainson, *Terebellum terebellum* Linné and *Conus generalis* Linné). No Gould types were in the collection.

Peale's main interests were butterflies and mammals, and his shell collection therefore was quite small. He never wrote about mollusks. He gave undescribed material to Say, Lea, Conrad, Jay, Barnes and Green. The Philadelphia Museum failed and was put up at public auction in 1846. P. T. Barnum purchased the collections in 1850, sent half to his New York Museum where it was demolished by fire in 1865, and the other half to his Boston Museum. The latter was acquired by the Boston Society of Natural History. Some of it may be in the Museum of Comparative Zoology at Harvard.

Peale joined the Patent Office in Washington, D. C., in 1848, and returned to Philadelphia in 1873 where he died on March 13, 1885 at the age of 85. A single-page "declaration of intent" dated 1877 by Peale in the Academy archives indicates that he intended to leave "three cabinets of shells and two boxes of fossil shells" to the Academy. However, a few years later he sold this private collection to Prof. James C. Booth, a friend and Academy member since 1837, and resident of Haverford, Pa. The collection was purchased in 1944 from Booth's daughter, Laurette, for the Academy by Charles M. B. Cadwalader.

The collection was in extremely poor condition, containing jumbled specimens and numerous labels, some of which bore no other data than "China" and "Pacific Ocean." Booth had added some material, one lot bearing the inscription "*Unio cariosa.* Jas. C. Booth, New York, 1836." The worthwhile material that could safely be documented included material from T. Nuttall, 1836; about 20 lots of Exploring Expedition material; Major Rich specimens from Peru and California, 1839–49; 11 holotype and cotypes of Isaac Lea; two cotypes of T. A. Conrad, one probable cotype of Say's and the specimen



FIGS. 1–6. Isaac Lea holotypes from the T. Peale collection: FIG. 1, *Bulimus lacteus* × 2. FIG. 2, *Ampullaria pealiana* × 1. FIG. 3, *B. corneus* × 2. FIG. 4, *B. columbianus* × 2. FIG. 5, *Megaspira ruschenbergiana* × 1. FIG. 6, *B. pealianus* × 2. FIGS. 7–8, *Emarginula ladowae* Eichman, × 5.

of *Helix lactea* which Say mentions receiving from Peale (American Conchology, pt. 6, p. 4 of cover 1834). One specimen of the rare *Liguus fasciatus* form *pictus* Reeve, was found without data, but presumably collected by Peale in Florida in 1824.

Cerithium dislocatum Say, 1822, Jour. Acad. Nat. Sci., vol. 2, p. 235. Label reads "Cerithium dislocatum T. S. Southern coast. U. S." in what looks like Say's handwriting. A.N. S.P. no. 192924. Probable cotype.

Pecten peali Conrad, 1831, American Marine Conchology, p. 12, pl. 2, fig. 2. Conrad states the type is in the Acad. Nat. Sciences no. 1400, but it has been missing since Conrad's day. The published locality is "mouth of a river on the coast of Maine, T. R. Peale." The species is synonymous with *Chlamys islandica* Müller. Four dead valves (A.N.S.P. no. 192925) had two labels in Peale's handwriting; "Pecten Pealii (Con.), Lapreau riv., N. B. T.R.P." They are cotypes.

Isocardia markoei Conrad, 1842, Bull. Proc. Nat. Inst. Wash., vol. 2, p. 193, pl. 2, fig. 1 (Captain Hance's Farm, Calvert Cliffs, Md. Medial tertiary). One valve (A.N.S.P. no. 19879) found with a label in Conrad's handwriting: "Isocardia markoei." Probably a cotype.

Megaspira ruschenbergiana Lea, 1838, Trans, Amer. Philos. Soc., vol. 6, p. 21, pl. 23, fig. 101. Two cotypes, A.N.S.P. no. 192928. Label in Lea's handwriting: "Megaspira Ruschenbergii Lea. Brazil. Dr. Ruschenberger" who knew Peale and was once a president of the Academy. This species is credited to Jay, 1836.

Bulimus pealianus I. Lea, 1838, loc. cit., vol. 6, p. 65, pl. 23, fig. 105 (near the rapids of Angostura, Colombia, T. R. Peale). Figured holotype (previously thought lost), A.N.S.P. no. 192929.

Bulimus lacteus I. Lea, 1838, loc. cit., p. 65, pl. 23, fig. 100 (Colombia, about 100 miles up the Magdalena River, T. R. Peale). Figured holotype (previously thought lost), A.N. S.P. no. 192930.

Bulimus corneus I. Lea, 1838, loc. cit., p. 66, pl. 23, fig. 111 Buenavista, Columbia, T. R. Peale). Figured holotype A.N. S.P. no. 192931 is 0.7 of an inch as stated by Lea. U.S.N.M. no. 105078 being less than 0.5 of an inch must be considered a paratype. Now *Bulimulus buenavistensis* Pilsbry 1897.

Bulimus columbianus I. Lea, 1838, loc. cit., p. 66, pl. 23, fig. 110 (about 100 miles up the Magdalena River, Colombia, T. R. Peale). Figured holotype (previously thought lost), A.N.S.P. no. 192932.

Carocolla hydiana I. Lea, 1838, loc. cit., p. 98, pl. 23, fig. 73

(near Porto Cabello, S. A.). Probably cotype from New Grenada, A.N.S.P. no. 192934.

Ampullaria pealiana I. Lea, 1838, loc. cit., p. 16, pl. 23, fig. 77 Turbaco, Colombia, S. A., T. R. Peale). Figured holotype, A.N.S.P. no. 192933.

Anodonta oregonensis I. Lea, 1838, loc. cit., p. 80, pl. 21, fig. 67 (Wahlamat, near its junction with the Columbia River. Professor Nuttall). Two cotypes, A.N.S.P. no. 192935.

Helix nuttalliana I. Lea, 1838, loc. cit., p. 88, pl. 23, fig. 74 (Fort Vancouver down to the ocean, Oregon). Three cotypes, A.N.S.P. no. 192936.

Conus mamillaris Green, 1830, Trans. Albany Inst., vol. 1, p. 123, pl. 3, figs. 5 and 6. (Florida, Mr. Peale). Two specimens from the original lot (not types), A.N.S.P. no. 192927. These are *Conus daucus* Hwass.

Conus pealii Green, 1830, Trans. Albany Inst., vol. 1, p. 123, pl. 3, fig. 3 (near Key Vache, Florida coast, Titian R. Peale). Seven worn specimens without a label were found in the collection. They are probably part of the original lot, but not types, A.N.S.P. no. 192926. They are *Conus jaspideus* Gmelin, as Clench in Johnsonia, vol. 1, no. 6, (1942) supposed. The only other Florida cones in the collection were *C. mus* Hwass and *C. spurius* Gmelin.

It is satisfying to know that a few types, hitherto thought lost, have been brought to light; but it is equally disheartening to know that such historical and valuable collections often fall into decay or are lost. Experience has now taught workers in our field that sharing paratypes with other large institutions is a form of collective insurance against neglect, possible fire, earthquakes and atomic bombs. I refer private collectors to a pending article by the Secretary of the American Malacological Union, Margaret Teskey, entitled, "It's Later Than You Think," which concerns the disposition of private collections.

The Peale collection also contained about a hundred lots of fresh-water mussels which I leave for some expert on Unionidae to study and report upon later, if so justified. One label reads, "Wabash River, T. Say. 1833," which indicates that Say, up until a few months before his death, was sending specimens to his young friend, Titian R. Peale.

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GASTROPODS OF THE BRIGHTON AREA, WASATCH MOUNTAINS, UTAH

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A review of the Utah molluscan literature (Chamberlin and Jones, 1929; Chamberlin and Roscoe, 1948) will reveal a paucity of published records from the higher (above 8,000 feet) montane regions of the state. The present paper deals with the gastropods from an area in the central Wasatch Mountains at elevations ranging from about 8,850 to 9,600 feet. Pelecypods from this area have been itemized in a previous report (Herrington and Roscoe, 1953).

Field work for this report was done intermittently from 1945 to 1947 as time from other duties permitted. We wish to express our appreciation to Dr. William H. Behle and Miss Mary Gibbs for the use of cabin facilities during portions of the study. Specimens are deposited in the University of Utah molluscan collection.

General Description of the Area

The specimens reported herein were collected in the vicinity of the town of Brighton, situated at the head of Big Cottonwood Canyon, Salt Lake County, approximately 20 miles east of Salt Lake City. Some of the highest peaks of the Wasatch Range are included in this picturesque year-round resort area. The present physiographic details are due mainly to the effects of Pleistocene glaciation. The sedimentary and metamorphic rocks

of the area range in age from Cambrian to Mississippian; there are also igneous intrusives of late Cretaceous or early Tertiary age. Pleistocene and Recent deposits are present locally. A detailed account of the geology of the area may be found in Calkins, Butler and Heikes (1943).

Complete climatological data for the Brighton area are not available. Precipitation data are given in Table I. The summers are pleasantly cool, fair weather being the general rule. Afternoon thunder showers are common, however, especially in the late summer. The winters are usually severe. Snow, which forms the bulk of the annual precipitation, may fall as early as the latter part of September; use of snow plows is often necessary to keep the road open in late spring. Small patches of snow may be found throughout the area in sheltered places well into summer.

TABLE I. Average monthly precipitation for 29 year period at Silver Lake, Big Cottonwood Canyon, Utah. El. 8,700 ft. (Source: U. S. Weather Bureau)

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
4.90	5.67	5.20	4.01	2.52	0.99	1.67	2.19	2.39	2.91	3.65	4.72	40.82

COLLECTING STATIONS

Our objective was to make as extensive a search as possible of the various habitats in the Brighton area in order to gather information on (1) the kinds of gastropods which occur in each, and (2) the altitudinal range of the various snails. Circumstances did not permit our making detailed ecological observations. A comprehensive ecological report on a comparable region in the southern Wasatch Mountains is available (Hayward, 1945).

Our collecting stations are listed below, with the nature of the habitat and the kinds of snails obtained indicated for each station. The exact location of each station is shown on Figure 1.

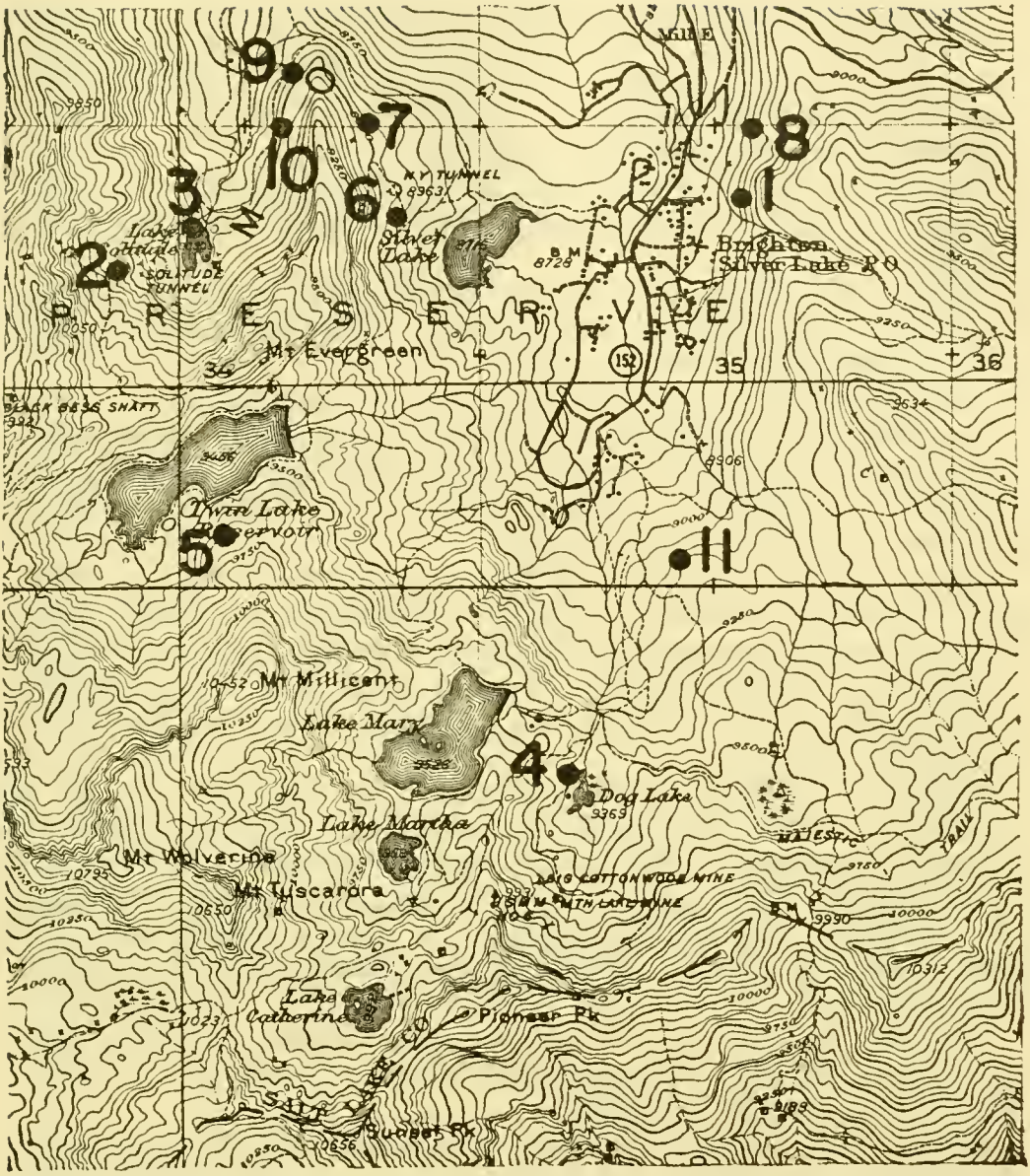

FIG. 1. Map of the Brighton area, Salt Lake County, Utah, showing collecting stations referred to in text. (From U.S.G.S. Topographic Sheet, Cottonwood Quadrangle, edition of 1939. Scale 1:25,000, contour interval 50 feet.)

Station 1. Ravine east of Brighton, el. *c.* 8,850 ft., September 2, 1945. Quaking aspen litter, morainic rock. *Vitrina alaskana* Dall, *Vertigo concinula* Cockerell, *Microphysula ingersolli* (Bland), *Zonitoides arboreus* (Say).

Station 2. Near trail between Lake Solitude and Twin Lakes, nearer the former, el. *c.* 9,350 ft., July 6, 1945. Herbaceous plants, limestone rock. *Oreohelix subrudis* (Pfeiffer).

Station 3. North end of Lake Solitude, el. 9,030 ft., September 3 and 4, 1945. On mud flats surrounding the lake which was at low water stage. *Lymnaea humilus modicella* Say, *Lymnaea palustris* (Müller). A specimen of *Discus cronkhitei* (Newcomb) was found in the drift.

Station 4. Near Dog Lake, el. 9,369 ft., September 5, 1945. Mossy meadow. *Vitrina alaskana* Dall, *Microphysula ingersolli* (Bland).

Station 5. South side of Twin Lakes, el. *c.* 9,600 ft., August 8, 1947. Conifer litter, igneous rock. *Vitrina alaskana* Dall, *Microphysula ingersolli* (Bland).

Section 6. Near trail to Twin Lakes, west of Silver Lake, el. *c.* 8,900 ft., September 3, 1947. Quaking aspen litter, limestone rock. *Pupilla blandi* Morse, *Microphysula ingersolli* (Bland), *Zonitoides arboreus* (Say), *Vallonia gracilicosta* Reinhardt, *Vitrina alaskana* Dall.

Station 7. Near trail between Silver Lake and Lake Solitude, el. *c.* 8,950 ft., September 3, 1947. Quaking aspen and conifer litter, predominantly the former; morainic rock. *Vertigo concinula* Cockerell, *Vitrina alaskana* Dall, *Zonitoides arboreus* (Say), *Microphysula ingersolli* (Bland), *Punctum minutissimum* (Lea).

Station 8. One-half mile northeast of Silver Lake, el. *c.* 8,900 ft., September 4, 1947. In granodorite rock slide. *Microphysula ingersolli* (Bland), *Oreohelix subrudis* (Pfeiffer).

Station 9. Near trail between Silver Lake and Lake Solitude, el. *c.* 8,950 ft., September 8, 1947. In rotting logs in spruce-fir zone, dolomite rock. *Vitrina alaskana* Dall, *Vertigo concinula* Cockerell.

Station 10. Near trail between Silver Lake and Lake Solitude, el. *c.* 9,000 ft., September 8, 1947. In diorite rock slide. *Oreohelix subrudis* (Pfeiffer).

Station 11. Near trail between Brighton and Dog Lake, el. *c.* 9,200 ft., September 4, 1947. Mixed aspen-conifer litter, morainic rock. *Microphysula ingersolli* (Bland), *Vitrina alaskana* Dall, *Punctum minutissimum* (Lea).

Discussion

To the above records should be added the names of three kinds of gastropods not collected by us but which have been previously recorded from the Brighton area, *viz.: Deroceras laeve* (Müller) at Silver Lake; *Euconulus fulvus alaskensis* Pilsbry, near Twin Lakes and west of Silver Lake; and *Succinea avara* Say, at Silver Lake. A total of 14 kinds of gastropods (12 terrestrial,

2 aquatic) are now known to occur in the Brighton region at elevations above 8,000 feet.

According to our observations, the most common snails of the area are *Vitrina alaskana* Dall and *Microphysula ingersolli* (Bland). Both kinds were found in 7 of the 12 stations reported herein. Much of the collecting was done in the aspen and spruce-fir associations, but many other habitats, at elevations up to 10,646 feet (Sunset Peak), were examined with negative results. We were unable to find snails at any site above timberline, which in this area is at an elevation of approximately 10,000 feet. Several small streams and all the lakes were examined, but only one aquatic habitat (Lake Solitude) yielded gastropods.

In general snails were found to be most abundant, both as to kinds and numbers of individuals, in sites in which both deciduous forest and limestone rock were present, *e.g.*, station 6. A combination of conifer forest and granite rock appeared to be least favorable to the development of a good gastropod fauna, *e.g.*, station 5. Our experience has been not only in the Brighton area but at other localities in the Wasatch and Uinta Mountains as well, that only a small admixture of deciduous trees is necessary to result in a much greater abundance of snails in the litter than is found in litter in pure conifer stands. A quantitative study of this problem should be undertaken.

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ELLIPTIO SPINOSUS IN THE ALTAMAHA RIVER

By IVAN R. TOMKINS

Some years ago, Dr. Francis Harper and the late Arthur Leeds followed the Bartram trail across coastal Georgia, and about that time Dr. Harper told me to be on the lookout for this mollusk. Later I read the autobiography of Joseph Le Conte who told of a trip about 1850 from his home at Midway to the "Lakes of the Altamaha" to look for the spiny clam. He probably followed the Old Post Road to Fort Barrington.

In October and November, 1954, my work with the Savannah District of the Corps of Engineers required me to make several trips to this locality, and on 19 October the first specimens were found, including two live ones. These latter were preserved in alcohol and given to Dr. Donald Scott of the University of Georgia at Athens. Other visits of an hour or so were made on 26 October; 9 and 17 November, and on 20 November Mr. Herman Cooledge and I took a boat from Everett City and looked over various sand bars up to Fort Barrington. On 17 November another live one was found which was preserved and sent to Dr. Henry A. Pilsbry. Since then a couple more visits have been made farther up river without finding any more specimens. It appears that the dead shells of *spinosus* are found commonly up to the mouth of Pen Holloway (Phin Holloway) River, but none above that point, though the three other species of mussels of the river are still common.

The center of abundance seems to be about a mile below Fort Barrington. Herman Cooledge and I picked up one hundred pairs of shells on one sand bar. No small shells have been found, and the scarcity of live ones seems to indicate that the nursery beds and perhaps the main body will be found in the "Lakes" (dead rivers) or the creeks, or possibly Penholloway River. 209 shells were measured and the largest was 116 mm long, the smallest 56 mm, and the average 68.72 mm.

This summer and fall the river stage has been the lowest of record, and the water was unusually clear. I waded in two feet of water, and looked for live ones without success. The mean high water slope (of the tidal estuary) meets the normal low water slope of the river between Upper and Lower Sansa-

villa, though it is doubtful if there is much salt water intrusion under normal conditions above Everett City. There is no visible ecological barrier, limiting *E. spinosus* to the river below Penholloway, and I have no knowledge how far it lives down stream. The localities mentioned can be found on the Everett City and Ludowici quadrangles of the U. S. Geological Survey.

One other point seems pertinent. The Altamaha River is a silt-laden stream, drawing much of its water from above the Fall Line. The neighboring Satilla and Ogeechee Rivers are Coastal Plain Rivers, are much younger, and generally carry "black water."

A NEW CRETACEOUS EMARGINULA

By CHARLES JETTER EICHMAN

Emarginula ladowae, **new species.** Plate 4, figs. 7 & 8.

Description. Shell small, thin, elliptical in outline, with a recurved apex overhanging the posterior outline. Surface has 30 subequal radial ribs, with traces of intermediate riblets near the lateral and anterior margins. The interstices are crossed by regular concentric ridges, not visible at the summits of the radials. There is a narrow slit fasciole, but a break in the anterior part of the shell has removed the part where an anal slit should be.

Named in honor of Dorothy S. LaDow, of Woodbury, New Jersey, a friend of an inspiring naturalist.

Dimensions. Length 4.6 mm., width 3.5 mm., height 2.1 mm.

Locality. Cliff of ravine at Haddonfield, Camden County, New Jersey. Type: ANSP No. 193149.

Distribution. Woodbury formation, Matawan group, Upper Cretaceous.

The shell is of unaltered material in fine condition and is filled internally with clay. Unfortunately, the part where the anterior slit should be has been broken away. *Emarginula ladowae* is similar in sculpture to *E. fissura* (Linné) of the British Pliocene to Recent seas, but differs from the latter by Cretaceous of New Jersey, or of the eastern United States so far as known.

The author wishes to express his indebtedness to Dr. Henry A. Pilsbry and John Dyas Parker for their helpful suggestions and acknowledge his appreciation for the encouragement received from Dr. Horace G. Richards during the past several years. He also wants to give recognition to Theodore M. Hesser, Jr., who first found the locality.

SETAEPOMA, A NEW GENUS IN THE SYNCERIDAE FROM THE SOLOMON ISLANDS

By WILLIAM J. CLENCH

In 1936, I. and B. Rensch published a *Japonia* (?) *hedigeri* from Bougainville Island (Revue Suisse de Zoologie **43**, p. 678, fig. 25). The genus in which they provisionally placed their species belongs in the Cyclophoridae. However, a series of this species collected by the Whitney Expedition indicates that it is not a *Japonia* but belongs to a new genus in the Synceridae. The radula of an additional species, yet to be reported upon, confirmed this diagnosis.

Setaepoma, new genus

Shells flattened to slightly elevated and possessing numerous spiral threads which are slightly raised above the shell surface. Periostracum producing long bristle-like processes which are in spiral arrangement and grouped into three bands, one above and one below the periphery and the third near the base of the shell. Operculum calcareous, moderately dished, multispiral and deeply grooved. Inner surface covered with periostracum, smooth and having a central papilliform nucleus. Genotype, *Japonia* (?) *hedigeri* I. and B. Rensch.

Setaepoma does not appear to be closely related to any other known genus in the Synceridae, at least on the basis of opercular characters. The cyclophorid type of shell is also quite different from most other syncerids being somewhat heavy and with a depressed spire.

CALVIN GOODRICH 1874–1954

The recent death of Calvin Goodrich at the age of 80 ended the career of one of the important contributors to North American conchology. He had already been affiliated with the mollusk division of the Museum of Zoology for many years when, in 1924, he was made an Honorary Associate Curator of Mollusks, while still editor of the Toledo Blade and the Newark Star-Eagle. Then, in 1926, he retired from the newspaper business and accepted an appointment as full-time Assistant Curator of Mollusks in the Museum of Zoology. In 1930, upon the resignation of Miss Mina Winslow, he was made full Curator, a position he held until 1944 when, at the age of 70, he retired to live in western North Carolina with the title of Curator Emeritus of Mollusks (1944–1954).

During the fifteen years (1929–1944) of his curatorship, the mollusk division made notable progress in two fields of investigation and in the growth of the collections. A series of expeditions were made into the rich limestone regions of the southern states and concerted efforts were directed toward elucidating better the ecology and distribution of the mollusks of Michigan. He was industrious and methodical and brought to the division concepts of production he had learned in his many years of activity in the business world. In addition to some eighty scientific papers published by him during the time of his curatorship, the collections grew from approximately 50,000 lots of accessioned mollusks to more than three times that number. Much of this phenomenal growth was due to the gift, in 1936, of the library and collections of the late Bryant Walker. The accessions made in connection with Goodrich's own studies and those of his students and collaborators were considerable. The incorporation of the huge Walker museum collections into a single working unit was in itself a notable accomplishment. As a consequence, during Goodrich's curatorship, the mollusk collection in the Museum of Zoology gained its status as one of the finest of its kind.

The correspondence filed in our division gives an illuminating account of Goodrich's training and development as an out-

standing conchologist. During his many years in editorial work he ardently pursued the study of mollusks, but his scientific development in the field appears to be due largely to the influence of two key workers, Bryant Walker and A. E. Ortmann. He began his long-continued correspondence and association with Bryant Walker of Detroit and Arnold Edward Ortmann of the Carnegie Museum in Pittsburgh, while he resided in Toledo. He used to relate how, in the 1910 to 1920 period, he would get into the surrounding country by street cars out of Toledo. At that time, Ortmann (letter to Goodrich dated Dec. 15, 1919) related how he was disappointed in collecting due to flash floods, and then added: "But I hope and trust you will not give up, for this winter, indeed, is over. Spring will come again!" He also asked that Goodrich give his "best regards to Mr. Walker, if you see him again: he is a conchologist to my liking and in systematic Najadology easily the foremost in this country."

Walker, Ortmann, and Goodrich corresponded with considerable regularity and they cooperated with one another in their field programs. One of the high points in Goodrich's career came when he went to southwestern Virginia with Ortmann. That trip was the subject of one of Goodrich's first papers entitled "Spring Collecting in Southwestern Virginia" (Nautilus, 27: 81–82; 91–95). Ortmann's enthusiasm and incredible knowledge of geology, physiography, botany, carcinology, etc., impressed Goodrich so much that he often reminisced about that excursion when we were in the field together. Ortmann later wrote to Walker (letter dated Oct. 15, 1913): "Mr. Goodrich is an enthusiastic collector, and he *knows* shells. I have tried to induce him to do geographic work in the Wabash, and according to a letter recently received he started on this work last summer. The Wabash needs study very badly. And that reminds me, is anybody ever going to take up Kentucky River?! Our knowledge of this is practically blank." The influence of Ortmann and Walker on Goodrich is clearly evident and one can readily trace the pattern of his work through this very fortunate association.

In letters from Ortmann to Goodrich one finds many constructive suggestions which Goodrich followed. For example, Good-

rich was encouraged to collect in Lake Erie, as well as in the Wabash-Maumee region. Ortmann wrote (Nov. 4, 1913):

"I want to urge you again to continue your collections in this region and to work out the distribution of various species in detail, chiefly with reference to the crossing over the divide. There is no question that there was *here* the main gate by which Lake Erie received its fauna (see Walker's paper) but just for this reason we shall study the particulars. Is there any actual connection of waters at present?"

These suggestions were followed and in a paper published in THE NAUTILUS a year later (1914) Goodrich discussed "Union of the Wabash and Maumee Drainage Systems."

In the meantime Goodrich became interested in the fresh-water operculates belonging to the pleurocerid group. Both Walker and Ortmann were helpful and enthusiastic supporters. These snails occur in tremendous numbers in most of the rivers of eastern United States. As in the case of the fresh-water mussels, many species were named at a time when there was little or no appreciation of the clinal tendencies so evident in those groups. The many specimens collected by Ortmann, H. H. Smith, Hinkley, and others, soon found their way to Goodrich. He himself made numerous expeditions mainly to study these animals in their environment. In addition to learning at first hand the ecological and distributional relationships of groups and species, Goodrich also attempted to interpret their distribution in terms of drainage history. In a letter, dated Dec. 3, 1920, Ortmann wrote:

"Your sketch of the Geological History of the relations between the Tennessee and the Alabama drainages was extremely interesting to me and I saw at once that you properly understood the questions involved, although your views possibly require modification in some points."

For at least thirty years Goodrich concentrated in his mollusk studies on the family Pleuroceridae. The number of papers he published on those groups would number at least two score; several of them approach monographic proportions. In 1937, at the Ann Arbor meeting of the American Malacological Union,

he was made a member of the standing committee responsible for publishing check lists on mollusks north of Mexico. He accepted this assignment with resolve and determination so that before his retirement a half dozen years later, several such lists appeared as follows; Pleuroceridae of: St. Lawrence Basin (Occ. Pap. 404); Mississippi Basin (406); Ohio River (417); Small streams of Alabama River System (427); Atlantic Coastal Plain (456); Pacific Coastal Drainage (469); and the Great Basin (485).

The clinial variation of the Pleuroceridae has already been suggested. There is no question but that forms of the upper parts of river grade into those of the lower. These clines involve several characters such as size, degree of sculpture and banding. Although Goodrich indicated some of the broader trends, just as Adams did with *Io*, many of the malacological relations are still in need of study.

Although a number of Goodrich's writings concern the Pleuroceridae, he has written a variety of mollusk papers which are of broad and basic interest. Among them are a handbook, "The Mollusca of Michigan" (1932); "A Revision of the Mollusca of Indiana" (1944); and numerous papers dealing with faunal observations in the many places he visited. In all, his scientific writings include some eighty-six titles. His interests were broad and he spent considerable time studying history. In that field he has one book to his credit: "The First Michigan Frontier" (1940). He had a genuine gift for writing and he also published a dozen or more articles in history journals and in the *Michigan Alumnus*. In the latter, his contributions bear such titles as: "Piping Time of War" (1937); "Sandburr Farm" (1938); "Rural Fences in Michigan" (1943); "The Lie of the Land" (1945); and "By Waterways West" (1947).

During the years of residence in Ann Arbor, he took an active interest in the affairs of the Michigan Academy, and was chairman of the Zoology Section in 1938. In 1931 he served as a founder of the American Malacological Union, attending most of the meetings since that time till his retirement; in 1934 he was vice-president, presided at the meetings in Buffalo for Wm. J. Clench (who was unable to be present), and in 1936 completed

his year of service as president by presiding at the meetings in St. Petersburg, Florida. He was a staunch and faithful member of the Bryant Walker Natural History Club and later took an active part when stalwarts from that group organized the Detroit Academy of Natural Science. He was also a member of the Limnological Society, the American Society of Ichthyologists and Herpetologists, and the Deutschen Malacologischen Gesellschaft. He regularly gave financial aid to struggling scientific journals and preferred to have his gifts remain anonymous.

When he retired in 1944, he moved to western North Carolina. Unfortunately, that region is difficult for one interested in mollusks. In a letter from Hendersonville (dated Nov. 12, 1944) he wrote:

"The paucity of shells continues. I have seen alive only a slug which lives at the edge of concrete sidewalks, and, I feel certain, is an importation. The rocks are highly metamorphosed primitives, and while the books speak vaguely of beds of limestone here and there, I haven't seen one. When gasoline becomes more available, if ever, I hope to drive over to the Smokies to our west—the western faces of which are lime."

Later he did manage to collect some specimens. As recently as 1950 he published observations (Nautilus, 1950) on one of the local freshwater snails, *Goniobasis proxima* (Say). On May 17, 1945, he sent a small package with a few species to the Museum and indicated the shipment would "give a notion as to how sparse the molluscan population is here." He then gave a more definite explanation of the circumstances, as follows:

"The mountains have been lumbered over. Then, here and there, clearings have been made, farmed until the soil was exhausted and then let to grow up to briars and weeds. On top of this destruction have been ravaging fires. It would seem that the survivors, such as they were, managed to hold only to a zone upon which clouds condensed. It may be that some day I will find a respectable population of shells, but that will be mere happenchance."

All his life Goodrich was a careful and systematic collector. He has contributed considerably to our knowledge of regions

which are now ruined by the many forces responsible for the destruction of our natural resources. A letter to Goodrich from Ortmann, dated Jan. 21, 1918, contains the following statement: "*Goniobasis* is disappearing fast in consequence of pollution of streams. Last summer I collected some good material in the upper Beaver drainage, but for the rest you hardly can find *Goniobasis* any more. Thus old material, collected 10 to 12 years ago, becomes very important."

Many areas in the South, as well as in Ohio, Indiana, and Michigan, where Goodrich formerly collected, experienced similar ravaging influences and his well labelled materials will prove of inestimable value in the future.

During his retirement, and when shells became scarce, Goodrich turned to other interests, mainly raising local ferns and studying the essentials of landscape painting. His garden at one time had over ninety ferns, including most of those listed for the county, as well as two not previously reported there. Those of his friends who received samples of his paintings realized that he had considerable latent talent as an artist.

His shrewd judgment struck me when I recently perused some of the letters he wrote during his retirement. In a letter dated Oct. 23, 1950, he predicted the time of his death, as well as to indicate that he had a sense of humor, when he wrote:

"I thank you for the answers to my questions. It is odd that I should have forgotten the name. . . . A freakish memory is another one of the degenerate characteristics of old age. I see by the insurance statistics that I am allowed four more years, and I may live them unless one of these wild hillbillies, loaded with valley tan, bangs me up on the road."

He died in the hospital at Asheville just four years later, Nov. 7, 1954.—Henry van der Schalie.

PARTIAL BIBLIOGRAPHY OF CALVIN GOODRICH

In all, there are 86 mollusk titles contributed by Calvin Goodrich. The following list contains only articles which appeared in journals other than The Nautilus. As an economy, the

reader is referred to 6 citations in the first index, an additional 43 in the second, and one in volume 63. Aside from two articles, the following 36 papers were published.

1916 A trip to the islands of Lake Erie. Ann. Carnegie Mus., 10: 527–531.
1921 Three new species of Pleuroceridae. Occ. Pap. Mus. Zool. Univ. Mich., No. 91, 5 pp., 1 pl.
1922 The Anculosae of the Alabama River drainage. Misc., Pub. Mus. Zool. Univ. Mich., No. 7, 57 pp., 3 pls.
1924 The Genus *Gyrotoma*. *Ibid.*, No. 12, 29 pp., 2 pls.
1928 *Strephobasis:* A section of *Pleurocera*. Occ. Pap. Mus. Zool. Univ. Mich., No. 19, 15 pp., 2 pls.
1930 Goniobases of the vicinity of Muscle Shoals. *Ibid.*, No. 209, 25 pp.
1931 The pleurocerid genus *Eurycaelon*. *Ibid.*, No. 223, 9 pp., 1 pl.
1931 *Pleurobema aldrichianum*, a new naiad. *Ibid.*, No. 229, 4 pp., 1 pl.
1931 Mollusks of Keweenaw County, Michigan. *Ibid.*, No. 233, 9 pp., 1 pl.
1932 I. On an increase in the naiad fauna of Saginaw Bay, Michigan. II. The naiad species of the Great Lakes (with Henry van der Schalie). *Ibid.*, No. 238, 14 pp.
1932 The Mollusca of Michigan. Mich. Handbook Ser., Mus. Zool. Univ. Mich., No. 5, 120 pp., 7 pls.
1934 Studies of the gastropod family Pleuroceridae. I. Occ. Pap. Mus. Zool. Univ. Mich., No. 286, 17pp., 1 pl.
1934 Studies of the gastropod family Pleuroceridae. II. *Ibid.*, No. 295, 6 pp., 1 fig.
1934 Studies of the gastropod family Pleuroceridae. III. *Ibid.*, No. 300, 11 pp.
1935 Studies of the gastropod family Pleuroceridae. IV. *Ibid.*, No. 311, 11 pp.
1935 Studies of the gastropod family Pleuroceridae. V, *Ibid.*, No. 318, 12 pp.
1936 *Goniobasis* of the Coosa River, Alabama. Misc. Pub. Mus. Zool. Univ. Mich., No. 31, 60 pp., 1 pl., 1 fig.
1937 Mollusca of Peten and North Alta Vera Paz, Guatemala. *Ibid.*, No. 34, 50 pp., 1 pl., 1 fig., 1 folded map (with Henry van der Schalie).
1937 Studies of the gastropod family Pleuroceridae. VI. Occ. Pap. Mus. Zool. Univ. Mich., No. 347, 12 pp.
1938 Studies of the gastropod family Pleuroceridae. VII. *Ibid.*, No. 376, 12 pp.
1939 Aquatic mollusks of the Upper Peninsula of Michigan.

Misc. Pub. Mus. Zool. Univ. Mich., No. 43, 45 p^p., 2 maps (with Henry van der Schalie).
1939 The scientific writings of Bryant Walker; an annotated bibliography. Occ. Pap. Mus. Zool. Univ. Mich., No. 402, 28 p^p.
1939 Pleuroceridae of the St. Lawrence River basin. *Ibid.*, No. 404, 4 p^p.
1939 Pleuroceridae of the Mississippi River basin exclusive of the Ohio River system. Occ. Pap. Mus. Zool. Univ. Mich., No. 406, 4 p^p.
1940 The Pleuroceridae of the Ohio River drainage system. *Ibid.*, No. 417, 22p^p.
1941 Two new species of *Goniobasis*. *Ibid.*, No. 426, 4 p^p., 2 figs.
1941 Pleuroceridae of the small streams of the Alabama River System. *Ibid.*, No. 427, 10 pp.
1941 Distribution of the Gastropods of the Chaba River, Alabama. *Ibid.*, No. 428, 30 p^p
1941 Studies of the gastropod family Pleuroceridae. VIII. *Ibid.*, No. 447, 13 p^p.
1942 The Pleuroceridae of the Atlantic coastal plain. .*Ibid.*, No. 456, 6 p^p.
1942 The Pleuroceridae of the Pacific coastal drainage, including the western interior basin. *Ibid.*, No. 469, 4 p^p.
1943 The Walker-Beecher paper of 1876 on the Mollusca of the Ann Arbor area. *Ibid.*, No. 475, 26 p^p., 1 map.
1944 Pleuroceridae of the Great Basin. *Ibid.*, No. 485, 11 p^p.
1944 Variations in *Strombus pugilis alatus*. *Ibid.*, No. 490, 10 p^p., 2 tables.
1944 A revision of the Mollusca of Indiana. Amer. Midl. Nat., 32: 257–326 (with Henry van der Schalie).
1945 *Goniobasis livescens* of Michigan. Misc. Pub. Mus. Zool. Univ. Mich., No. 64, 36 p^p., 1 pl., 1 fig., 1 map.

TODD LOPEZ MOISE

Conchologists and his many Florida friends will grieve the passing of Todd L. Moise, who died in Elyria, Ohio, on August 25, 1954, at the age of seventy-seven years.

Mr. Moise was born October 24, 1876, at Versailles, Kentucky. In 1906 he married Mary Louise Ely, whose family has been the founders of Elyria, Ohio, where he settled and remained throughout most of his business career, establishing a well known and

successful accounting firm there. His civic interests were many, he having been a leader in the Community Chest movement since its inception and one of the Elyria Memorial Hospital's most active supporters. He was a member of the Elyria Country Club, the Union Club of Cleveland, the Miami Yacht Club and the Academy of Natural Sciences of Philadelphia.

Mrs. Moise died at Naples, Florida, early in 1953. Four children survive: Mrs. Elizabeth M. Ryder of Malibu, California; George E. Moise of Palatine, Illinois; Todd M. Moise of Chicago, Illinois; and John C. Moise of Glastonbury, Connecticut.

During his later years, Mr. Moise enjoyed vacations nearly every winter at the Naples Beach Hotel in Florida, and with the Gulf of Mexico near at hand it was not long before he became a shelling enthusiast. During the year 1949 further heights were reached when he purchased a small Steelcraft, the "Astraea," from which localities further afield could be visited and dredging in a small way made possible. About this time the capable services of Capt. Robert Bowers were engaged and a lasting friendship was begun which remained throughout the later collecting years. During this period, a number of trips were made on the "Astraea" ranging from the Islands around Naples to Key Largo. Two important dredging trips were made off northwest Florida, at Destin, in the Gulf of Mexico. The first was in a chartered boat, but the second was in his newly acquired "Astraea II" which was a large power cruiser equipped with winch for dredging. Many fine shells were dredged from this interesting part of the Gulf. Further dredging was done off Naples, Palm Beach, Key Largo and Marathon.

In the fall of 1953, a larger sea-going motor-sailer, the "Escape," was purchased by Mr. Moise for operation further afield. During 1954 collecting trips were made aboard her to the Bahama Islands and the Florida Keys, including the remote Dry Tortugas. An extensive dredging cruise followed in the Gulf of Mexico with bottom samples taken from as far west as the Mississippi Delta area.

The conchological collection of Mr. Moise has been presented to the Academy of Natural Sciences in Philadelphia. It is a

very valuable collection from a museum stand-point as it is largely made of dredged material with accurately recorded data. THOMAS L. MCGINTY, Boynton Beach, Florida.

NOTES AND NEWS

BACK FROM CEYLON.—We returned to the University of Arizona from Ceylon just one day before the spring semester classes started. Briefly, my stay in Ceylon was packed, exciting, and altogether too short. I did find a disease in the giant snails and continuing work on that aspect of my research will keep me busy for some time. I am now making a report on the findings for the meetings of the Pacific Science Board in Hawaii next week.—ALBERT R. MEAD (extract from letter).

PUBLICATIONS RECEIVED

THE SILENT WORLD. By Capt. J. Y. Cousteau with Frédéric Dumas. 225 pp., including 32 of photographs and 16 colored. Cardinal Edition. Pocket Books, Inc., New York, N. Y. 35¢. 1955.—This little book, originally published by Harper and Bros. (1953), describes diving adventures with an aqualung. About the only mollusk figured is an octopus, which the authors found as harmless as usual. Of course, Hugo's nature faking (1866) was exposed soon after it appeared (By Fischer in the Jour. de Conch., if remembered correctly).—H. B. B.